Vol. XX No. 2

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ANN ARBOR, MICHIGAN: 1959

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AGRICULTURE, GENERAL

A STUDY OF SOME EFFECTS OF FOUR LEVELS OF GRAZING INTENSITY UPON THE PERFORMANCE OF LACTATING COWS.

(L. C. Card No. Mic 59-2946)

Melvin Joseph Anderson, Ph.D.
Cornell University, 1959

An experiment was designed to study the following levels of grazing intensity and their effects upon the performance of lactating cows: zero grazing (in which fresh-chopped, green forage was fed daily), grazing rotationally three- and six-paddock units and grazing a new area of forage each day. The latter treatment served as a control for the other grazing treatments in which the animals were rotated among three and six paddocks, respectively, during the season. The same acreage and same stocking rate was employed for all three grazing treatments. Milk production data were obtained from 24 (6 animals per treatment) and 32 (8 animals per treatment) animals in 1956 and 1957, respectively. The digestibility and intake of forage dry matter by 16 of these animals were determined each year.

Milk yield per animal was lower for the zero grazing treatment than for the rotational grazing treatments. The animals of the strip-grazing group did not produce more milk in 1956, and produced less in 1957, than the animals maintained under the rotational-grazing treatments.

The digestibility of the harvested, green forage was significantly less than that of the forage consumed by grazing animals. This is probably the result of the reduced opportunity for selective feeding which exists under hand-feeding conditions. The highest digestion coefficients were obtained from strip grazing. This is probably the result of the consumption of a more uniformly high quality forage afforded by an opportunity to graze selectively.

The intake of forage dry matter was greatest for animals on zero grazing and least for those of the strip-grazing treatment. The digestible dry matter intake as forage and concentrates was higher for cows producing the most milk since milk production was the basis of concentrate feeding. However, less milk was produced per pound of concentrates consumed by animals on the zero- and strip-grazing treatments in 1956 and by those of the zero-grazing group in 1957 than by those in the other groups. The cows in the six-paddock system consumed more digestible dry matter in 1956 than did the cows of any other treatment and the consumption was higher by the cows of both of the rotational-grazing treatments than by the cows of the other two systems in 1957.

More excess forage was obtained from the "green-chop" area than from the areas involved in the conventional grazing treatments. The areas used for grazing produced approximately the same amount of excess forage. The extra forage from the zero-grazed area probably would not compensate for the additional milk produced by the grazing animals.

From the results of this experiment the following conclusions seem justified:

1. Grazing intensity can be influenced more by the number of animals grazing and the period of time during which grazing is allowed than by the method of grazing management employed.
2. The stocking rate of pasture experiments should not be determined subjectively by the research worker. Where the production yield per acre is an important consideration, the stocking rate necessary must be determined by objective means.
3. Zero grazing and strip grazing were not superior to less intensive systems of management when efficient utilization of available forage was obtained, i.e., when the stocking rate was adequate.
4. Careful management is required in the use of green-chop feeding programs in order to supply high-quality forage during the entire season. It is necessary to clip and harvest adequate areas at prejudged times to provide a sufficient regrowth during the entire season.

Microfilm $2.00; Xerox $6.80. 145 pages.

FACTORS AFFECTING THE NUTRIENT CONTENT AND YIELD RESPONSE OF CORN TO NITROGEN, PHOSPHORUS, AND POTASSIUM FERTILIZATION.

(L. C. Card No. Mic 59-2510)

Bruce Lloyd Baird, Ph.D.
North Carolina State College, 1959

Supervisor: James Walter Fitts

Applications of nitrogen, phosphorus, and potassium fertilizer, each at five levels, were made in 60 corn fertility trials conducted on Norfolk and Portsmouth soil series in North Carolina. The former soils are well drained and low in organic matter and the latter have developed under poorly drained conditions and are high in organic matter.

The yield was determined for all locations; the nitrogen, phosphorus, and potassium content of the leaves and grain for 38 locations; and the calcium and magnesium content of the leaves and grain for 18 locations of the trials. Emphasis was placed on the evaluation of the dominate factors which affected the nutrient content of the plants and yield in the integrated host of environmental factors occurring on these two soil series.

The responses of corn to the applications of nitrogen were generally larger for locations on the Norfolk than the Portsmouth series. A deficiency of rain resulted in a reduction of response. The correlation of nitrogen in the

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leaves or grain with yield were high for low rates of nitrogen increased. The highest rates of nitrogen application (250 pounds of nitrogen per acre) occasionally depressed the yield below the maximum obtained from lower rates.

Increases of the yield of corn by applications of phosphorus were rarely obtained for the Norfolk and were occasionally obtained for the Portsmouth soil series. The increases of the phosphorus content in the leaves were much larger and more general by nitrogen applications than the occasional responses attributed to applications of phosphorus.

The additions of potassium seldom increased yield, consistently increased the percent potassium in the leaves, and often depressed the calcium and magnesium contents of the leaves. The magnitude of the responses were inversely related to the amount of the respective cations in the soil.

With the exception of nitrogen the nutrient content of the grain was affected little by fertilization or other factors.

The phosphorus, potassium, calcium, and magnesium content of the soils and responses obtained to fertilization reflected the fertilization and liming practices associated with the soils.

Tagged nitrogen (N^{15}) and phosphorus (P^{32}) fertilizers were used with a split root system of corn in the greenhouse to study the relations of nitrogen and phosphorus fertilization to the absorption and translocation of these nutrients in corn plants. The total nitrogen and the portion of the nitrogen from the fertilizer in the leaves were increased more by the ammonium than the nitrate form of nitrogen. Source of nitrogen had little affect on the phosphorus content of the leaves. Similar but less pronounced effects were observed for the roots on the side of the plant opposite that of fertilizer placement.

Microfilm $2.45; Xerox $8.60. 187 pages.

CONSUMER PREFERENCES FOR INTERIOR QUALITY OF EGGS.

(L. C. Card No. Mic 59-2621)

Lloyd Dale Bender, Ph.D.
University of Missouri, 1959

Supervisor: Dr. V. James Rhodes

The fundamental purpose of this thesis was to solve certain of the practical problems associated with grading and merchandising shell eggs in the consumer market. The objectives were to determine (1) the important interior attributes of shell eggs, (2) the importance of the interior attributes relative to population aggregates, and (3) to determine the weights assigned to these important physical attributes in the evaluation of the total product quality. The results of the study indicated the attributes which should be used as grade criteria as well as indications of grade boundaries derived from combinations of attributes.

Previous studies had used photographs of brokenout eggs as models and had drawn inferences from tabulations of ranked choices and consumer comments. It appeared that only one attribute was assumed to be important and that the preference function was assumed linear. Conclusions of universal preferences and inconsistencies followed from these analyses.

A conceptual framework in this thesis explicitly recognizes constellations of motives, means, and ends as being important to behavior. This framework emphasized individually patterned totalities, immediacy, subjectivity, and dimensionality.

A methodology study of forty-nine consumers in Columbia, Missouri served to crystalize several techniques of analysis. This study indicated that there was little difference between the single- and multiple-stimulus techniques of interviewing.

Completed interviews were obtained from 190 respondents in Marshall and Windsor, Missouri, and from 378 in St. Louis, Missouri. Multiple stage cluster samples were drawn. The procedure of the surveys in both areas was to break out three grades representing U.S.D.A. grades A, B, and C, and to obtain comments on the attributes as well as ratings on each grade on a zero to nine rating scale.

The display eggs were generally ranked in the order ABC by the converted rating scores indicating that respondents did notice differences. However, the ABC ordering was progressively less important, depending upon the attributes used as criteria by the respondents, in the order of consumer comment groups (1) albumen and yolk, (2) albumen only, (3) yolk only, (4) no comment on either the albumen or yolk. The consumer group commenting on the chalaza rated the eggs in the order BAC. There were significant differences between the grade A and B group means for only two groups comprising forty-seven per cent of the sample. The results indicated that considerable variation in the measurements of interior egg attributes would be tolerated by consumers. This would be particularly true if the interview situation differed greatly from a normal household use situation where attributes would not be closely evaluated.

There were only isolated sources of significance in the rating scores when sorted on the basis of socioeconomic factors. Data collected on purchase habits also indicated that a wide range of tolerance would probably be permitted by consumers with respect to interior attributes. The interior attributes of shell eggs are probably over shadowed in the purchase decision by ordered grade labels and dealer preferences.

Microfilm $3.00; Xerox $10.20. 230 pages.

TRANSMISSION OF CABBAGE VIRUSES A AND B BY THE CABBAGE AND GREEN PEACH APHIDS.

(L. C. Card No. Mic 59-2764)

Richard Bruce Chalfant, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor R. Keith Chapman

Studies on insecticidal control, field spread, and transmission, particularly of cabbage viruses A and B (CVA and CVB) were conducted. In the greenhouse transmission tests on CVA and CVB were performed with the peach

aphid (Myzus persicae Sulz.) and the cabbage aphid (Brevicoryne brassicae L.). The acquisition threshold for both viruses in both vectors was 15 seconds or less, and the inoculation threshold was in a similar range. Transmission was more efficient if aphid feeding was naturally terminated rather than forcibly interrupted.

Transmission of CVA by both aphids and CVB by the peach aphid was of a nonpersistent nature. Long acquisition decreased transmission efficiency, there being few infections after 5 hours. CVA was not retained beyond 1 hour in feeding and 16 hours in starving vectors, and CVB was retained by the peach aphid for a somewhat shorter time. In the above cases, there was no transmission beyond the second plant in a series using 5 minute inoculation feeds.

Long acquisition by the cabbage aphid did not decrease transmission efficiency of CVB, and the following results indicate that this virus is transmitted both persistently and nonpersistently by the cabbage aphid depending upon the length of acquisition. A summary of 11 acquisition tests showed a highly significant bimodal efficiency curve with peaks in transmission at 5 minutes and 8 hours which were significant from a 15 minute trough. Tests on persistence in feeding and starving aphids showed that the virus retention was increased with long acquisition feeds. If 5 minute inoculation feeds were used in a series, the retention of CVB was also increased with long acquisition. Infections in a series of 30 second inoculation punctures did not indicate any increase in virus charge with long feeds. When the bared stylets of cabbage aphids were treated with formalin after short or long acquisition, transmission was prevented in the former but not the latter, indicating that CVB is located on the stylets of this aphid during short feeds and elsewhere after long acquisition.

In 1955 and 1956 at several locations, various factors were studied regarding the field spread of cabbage mosaic (a CVA - CVB complex). A single infected plant placed in the field had a marked influence on virus spread, but this was overshadowed when there were abundant virus sources outside the field. Sticky barriers did not protect plants from outside infection, indicating that apterae may not be important to virus spread. The incidence of cabbage mosaic generally increased as the season progressed, and there was apparently more spread of CVB than CVA. The pattern of virus spread obtained from recording aphid populations and mapping infections in several tests indicated that early infection was from viruliferous, winged peach aphids entering a field and initiating primary virus sources from which secondary, short-distance spread occurs, possibly by cabbage aphids. This results in pools of infected plants throughout the field.

Control experiments were conducted on several virus diseases, using particularly, long-lasting, systemic insecticides. Tests included a cabbage and cucumber mosaic control field in 1954; two fields in 1955 which were treated simultaneously against infection by cabbage, cucumber, and bean mosaics, potato virus Y, aster yellows, and pea enation in their respective hosts; and two fields treated against CVA and CVB respectively in 1956. Partial control of cucumber mosaic occurred using parathion and soil and foliage applications of Am. Cyanamid 12008 and Thimet. In 1955, incidence of cabbage mosaic was reduced with Thimet, 12008, and parathion foliage applications. No positive results were obtained in the other cases, and failure of insecticides to control these viruses was attributed to numerous infections entering a field from outside sources.

Microfilm $2.55; Xerox $8.80. 195 pages.

SOD SUBJUGATION WITH HERBICIDES AND OTHER CULTURAL PRACTICES FOR PASTURE RENOVATION.

(L. C. Card No. Mic 59-2887)

Joseph Donald Harrington, Ph.D.
The Pennsylvania State University, 1959

On the basis of major land use in Pennsylvania more than 3.5 million acres are classified as permanent pasture. Of this acreage approximately 2.5 million acres or 70 percent is regarded as unimproved permanent pasture (1950 census). The climax vegetation is generally characterized by low productivity and is often of inferior nutritional quality. Since it is almost universally agreed that animal products can be produced at lowest costs when animals are on pasture, the primary aim of an improved pasture program is to provide productive, nutritious pasturage within the limits prescribed by the growing season. The economic significance of pasture improvement to Pennsylvania farmers becomes further apparent when it is realized that approximately 50 percent of the gross income on the Commonwealth's farms is derived from forage-consuming livestock.

Renovation practices alone often have doubled or tripled production over unimproved permanent pastures. However, at present large tillage implements are used to break up the unproductive sod; but because of high machinery and operational costs pasture renovation has not been commonly accepted. Consequently, a practice which would reduce these fixed costs and yet allow for the establishment of superior pasture species would make pasture renovation more widely acceptable. It is reasonable to expect that the use of herbicidal chemicals with little or no lasting effects in the soil, together with the commonly accepted principles of pasture renovation, might afford a solution to this pressing problem.

Thus, in order to explore the potential use of herbicidal chemicals for sod subjugation on established permanent pastures in conjunction with other cultural practices in grassland improvement, field experiments were initiated in July 1955, July and August 1956 and April 1957, and a greenhouse experiment in April 1958 at State College, Pa. Evaluations were made at periodic intervals on the effectiveness of chemical applications as indicated by the percentage of Kentucky bluegrass top-kill and percentage of bluegrass recovery following herbicidal treatment. The active ingredients of chemicals employed at various concentrations and applied at different seasons of the year in one or more different phases of these studies included; 3-amino - 1, 2, 4-triazole (amino triazole); sodium 2, 2-dichloropropionate (dalapon); sodium 2, 2, 3-trichloroproprionate (EH 6249); and sodium trichloroacetate (TCA).

Superimposed on chemical treatments were seeding methods involving the following perennial species; Viking or Empire birdsfoot trefoil and common timothy seeded

either alone or in association. Residual effects as manifested by toxicity to seedlings and subsequent poor establishment following herbicidal treatment were measured in terms of dry matter productivity of the succeeding seeded species.

The results obtained are summarized as follows:

1. The effectiveness of herbicides in the suppression of Kentucky bluegrass varied with year and season of application.
   a. Spring applications of chemicals made in 1957 were more effective than those applied during July, August and September of 1955 and 1956.
   b. Herbicidal applications made in July 1955 were less effective than those made in August and September 1956.
2. The most effective herbicides for the suppression of Kentucky bluegrass and other indigenous grasses in permanent pastures were found to be amino triazole and dalapon, applied at 10.0 and 15.0 pounds of A.E./A., respectively. The least effective herbicide was EH 6249.
3. Effectiveness of herbicides appears to be related to soil moisture conditions as indicated by the greenhouse experiment.
4. No evidence of toxicity or other deleterious residual effects resulting from the use of herbicides were found during the course of this investigation.
5. Forage yields obtained with the seeded birdsfoot trefoil generally were related to the degree to which competition from the Kentucky bluegrass was minimized by its suppression with the herbicides.
6. Higher forage yields after chemical renovation were obtained with birdsfoot trefoil and timothy, alone, and in association, broadcast-seeded and band-seeded in rows 7 inches apart, than when band-seeded in rows 11 inches apart with a grassland drill.
7. When plowing and herbicides were compared for pasture renovation, plowing was more effective than chemicals not only in the suppression of the grasses present but the seeded species produced larger forage yields.

Microfilm $2.00; Xerox $5.40. 107 pages.

POPULATION DENSITY AS A PHYSIOLOGICAL STRESS IN YOUNG MALE CHICKENS.

(L. C. Card No. Mic 59-2915)

Herbert S. Siegel, Ph.D.
The Pennsylvania State University, 1959

Commercial poultrymen are turning to flock intensification as a means of counteracting rising costs of buildings, equipment, labor and other overhead. The objectives of this research were to determine (1) whether extreme population density produced the symptoms of adaptation associated with physiological stress in poultry and (2) the age and level of density where such symptoms became physiologically significant.

The general criteria used were: (1) effects on the weight of endocrine glands and their target organs; (2) effects on adrenal cholesterol concentration; and (3) effects on the histology and histochemistry of the adrenals, bursa of Fabricius and testes.

Incrossbred White Leghorn cockerels were confined from 5 to 17 weeks of age at floor spaces of 1.0, 0.8, 0.6 and 0.4 square foot per bird. At weekly or biweekly intervals, sample birds were taken from each floor space group, sacrificed, and adrenals, thyroids, pituitaries, bursa of Fabricius and testes removed. These were weighed and samples taken for histological and histochemical observations. The remaining adrenals were saved for total adrenal cholesterol determinations.

Results indicated that after 9 weeks of age the adrenal glands of birds maintained at 0.4 square foot per bird were significantly heavier than those at 1.0 square foot per bird. It was also shown that the right adrenals of all groups were consistently and significantly heavier than the left and that the left gland was apparently more sensitive to the effects of population density than the right. There was a tendency for higher pituitary weights in more densely populated groups, but the thyroids, bursae of Fabricius and testes were not consistently affected.

A mild but significant depletion of adrenal cholesterol was noted after birds had been confined at higher density levels for 3 to 4 weeks. Histological observations revealed cortical area hypertrophy in the adrenals of those confined at 0.4 square foot per bird when compared to those at 1.0 square foot per bird; the severity was apparently associated with length of time of confinement. Staining specifically for lipids revealed definite indications of hypersecretion in the high density groups, the greatest difference between high and low density groups appearing at 15 weeks of age. There were no clearly defined differences in the histology of the bursae or testes of birds from different population density groups.

It was concluded that:

(1) In high population densities, symptoms of adaptation associated with physiological stress were produced in young male chickens.

(2) In ages up to 17 weeks a density level between 0.6 and 0.4 square foot per bird was necessary to produce definitive symptoms.

(3) Under optimum conditions, in ages up to 17 weeks, population density as low as 0.4 square foot per bird did not exceed the birds' adaptive abilities. However, the fact that defensive responses were elicited in birds confined at high population density makes it conceivable that there are density levels where the adaptive abilities of the bird would be overcome.

Microfilm $2.00; Xerox $6.80. 145 pages.

AGRICULTURE, ANIMAL CULTURE

TRACER STUDIES OF THE PERFUSED RUMINA AND LIVERS OF GOATS.

(L. C. Card No. Mic 59-2533)

Robert David McCarthy, Ph.D.
University of Maryland, 1958

Supervisor: Dr. Joseph C. Shaw

By the use of a pump-oxygenator apparatus the rumina of goats were perfused with heparinized blood. In two different perfusions butyrate-1-C^{14}Na was added to the perfusate or to the rumen contents at the initiation of the experiment. In a third experiment, propionate-1-C^{14}Na was added to the rumen contents.

The results show that large quantities of VFA are produced in the rumen. On a diet of hay plus grain, the relative production of VFA was in the order acetate > propionate > butyrate > "higher acids" > valerate. Interconversion of VFA occurs in the rumen. Butyrate was converted to acetate and propionate and to a lesser degree to valerate and lactate. Propionate was converted in small amounts to valerate and acetate but not butyrate.

In general, the relative amounts of the acids absorbed were a reflection of the production and molar per cent of the various acids in the rumen. The relative quantities absorbed were in the order acetate > propionate > butyrate > "higher acids" > valerate. Under certain conditions, lactate is produced in and absorbed from the rumen.

The ruminal tissue utilizes glucose and formate from the blood. Under many circumstances there is apparently a moderate net production of ketone bodies by the ruminal tissue. Results from the tracer experiments makes it doubtful that butyrate is converted directly to ketone bodies by the ruminal tissue. A portion of the blood lactate may arise from ruminal tissue metabolism. Rumen butyrate apparently provides an intermediate in ruminal tissue metabolism which contributes to the formation of blood lactate. Propionate within the rumen does not contribute to the formation of blood lactate; apparently it is metabolized to a limited degree by the rumen tissue as indicated by the appearance of label from propionate in blood formate.

The production of VFA within the rumen is capable of providing approximately 75 per cent of the estimated maintenance energy requirement of the host animal. The quantity of VFA absorbed in these experiments would be capable of providing only 8 to 21 per cent of the estimated energy requirements.

The livers of goats were perfused with heparinized blood through the portal vein by the use of a pump-oxygenator apparatus. Complete mixtures of VFA were added to the perfusate in each perfusion. In addition carboxyl-labeled formate, acetate, propionate and butyrate were each added to a different perfusion.

The results of these perfusions indicate that valerate, butyrate and propionate are removed from the blood and metabolized by the liver. Butyrate, propionate, and formate contribute heavily to carbohydrate metabolism and the formation of glycogen. Formate was produced by the liver, there being a two to three fold increase in the blood. Even though there was a net increase in formate, the formate pool contributed markedly to glycogen formation.

The total level of acetate within the blood increased slightly during perfusion. This, and the fact that most of the acetate label remained as such in the blood, indicates that acetate arising from the rumen passes unaltered through the liver and is presented as such to the extra-hepatic tissues.

Ketone bodies were produced in large quantities by the perfused liver. There was only insignificant labeling in the ketone bodies isolated from all tracer perfusions. Since there was only moderate labeling in the liver lipids it appears that the ketone bodies arise from this source. Glucose was produced by the perfused liver. The production was above normal, but was characteristic of liver perfusion experiments.

There was moderate labeling of a nucleotide fraction isolated from liver tissue. The greatest incorporation into this fraction occurred with formate and propionate followed by acetate and butyrate.

Microfilm $2.00; Xerox $5.80. 120 pages.

STORAGE OF BOVINE SEMEN AT LOW TEMPERATURE (-79°C) USING RECONSTITUTED BUTTERMILK AS AN EXTENDER.

(L. C. Card No. Mic 59-2517)

Nityananda Pati, Ph.D.
North Carolina State College, 1959

Supervisor: Lester Curtis Ublerg

Experiments were conducted using semen from Holstein bulls to determine whether bovine semen can be stored at low temperature (-79°C) using reconstituted buttermilk as an extender. The optimum concentration of glycerol in reconstituted buttermilk for maximum recovery of live sperm after freezing (-79°C) was found to be 8.8 per cent. An equilibration time of 6 hours was as satisfactory as 18 hours for maximum recovery of live sperm. A dilution rate of 20 million live spermatozoa per milliliter of diluted extended semen was used in the last experiment. Two ejaculates from the same bull were split in milk, buttermilk and egg yolk-citrate extenders, using 9 bulls in each of four replicates with a total of 72 ejaculates. A comparison of live and dead sperm was made on stained slides before freezing as well as on thawing after 10 days storage at -79°C. Reconstituted buttermilk gave an average of five per cent higher recovery of live sperm in comparison to milk and egg yolk-citrate. Although the number of live sperm was higher in the first ejaculates after collection in comparison to second ejaculates, the higher percentage of live sperm was recovered from the second ejaculate.

Microfilm $2.00; Xerox $3.00. 49 pages.

INTERRELATIONSHIPS BETWEEN THE METABOLISMS OF SHORT-CHAIN FATTY ACIDS BY RUMINANT TISSUES.

(L. C. Card No. Mic 59-2518)

Gerald Ian Pritchard, Ph.D.
North Carolina State College, 1959

Supervisor: Samuel B. Tove

The metabolisms of short-chain fatty acids by ruminant tissues and interrelationships between these metabolisms were investigated. Livers from sheep that were fasted six to eight days to lower the glycogen concentrations were the primary source of tissue.

Acetate, n-butyrate, propionate and iso-butyrate, all of which were labeled in the carboxyl position with C^{14}, were metabolized in vitro by the liver of sheep. The C^{14} from labeled acetate was readily recovered in carbon dioxide, lipids and protein, and small amounts were found in the acids of the citric-acid cycle. The incorporation of C^{14} from labeled n-butyrate followed a pattern similar to that from labeled acetate. When labeled propionate was incubated with liver slices, C^{14} was readily incorporated into carbon dioxide, acids of the citric-acid cycle, glucose and protein, but the amount of C^{14} recovered in the lipids was negligible. The C^{14} from iso-butyrate was recovered predominantly in carbon dioxide. All of these findings are in accord with expectations based upon our general knowledge of metabolic pathways. The major pathway of propionate metabolism in the ruminant liver was found to be via succinate and the citric-acid cycle.

The rate of the metabolism of acetate was slow relative to the metabolic rates of n-butyrate and propionate. The existence of some unknown rate limiting factor in acetate metabolism was indicated.

Interrelationships between the metabolisms of short-chain fatty acids were investigated. When acetate was incubated with propionate and sheep-liver slices, the metabolism of acetate was depressed by propionate and the metabolism of propionate was stimulated by the presence of either acetate or glucose. The mechanism of this interrelationship has not been elucidated.

The presence of n-butyrate caused a marked stimulation in the metabolism of propionate by sheep-liver slices. Propionate, however, did not stimulate n-butyrate metabolism. Metabolism of propionate was also stimulated by the addition of iso-butyrate, β-hydroxybutyrate, n-valerate, caproate or caprylate, respectively. Citrate, succinate and α-ketoglutarate failed to stimulate the metabolism of propionate.

The possibility of an energy linkage between the metabolism of n-butyrate and the metabolism of propionate was eliminated. The most probable explanation for the interrelationship between the metabolism of n-butyrate and propionate is an enzymatic transfer of coenzyme A from n-butyryl coenzyme A to propionate.

Evidence in support of the existence of a coenzyme A transphorase in ruminant tissue was obtained. The presence of either n-butyrate or n-butyryl coenzyme A stimulated the metabolism of propionate but had no stimulatory effect upon the metabolism of propionyl coenzyme A. Also, C^{14}-propionyl coenzyme A was isolated from the reaction of propionate-1-C^{14} and n-butyryl coenzyme A.

Microfilm $2.00; Xerox $5.20. 105 pages.

A STUDY OF FACTORS INFLUENCING THE FREQUENCY DISTRIBUTION OF RETURNS OF COWS BRED ARTIFICIALLY WITH FLUID AND FROZEN SEMEN.

(L. C. Card No. Mic 59-2373)

Vallam. Venkataswami, Ph.D.
University of Minnesota, 1959

A study was conducted to determine the factors that influence the frequency distribution of returns of cows bred artificially with fluid and frozen semen. The investigation included a total of 25,943 returns of which 10,733 were from fluid semen extended in egg-yolk citrate; 10,123 from fluid semen extended in heated, homogenized whole milk and 5,087 from frozen semen. Of the 10,733 returns of cows bred with semen extended in egg-yolk citrate 5,463 and 2,000 returns were tabulated respectively by individual sire and age of extended semen. Of the 10,123 returns of cows bred with semen extended in milk 4,630 and 2,193 were tabulated respectively by individual sire and by age of extended semen.

Only first service cows that subsequently returned for second service after varying intervals of time following the first service were considered. Cows that returned for second breeding on the 11th day or thereafter following the first service were included in the study concerning the effect of fluid semen extenders on frequency distribution of returns. While considering the returns with frozen semen, only those that returned for second breeding the 11th day or thereafter and not later than 73 days following first-service were included since the returns with frozen semen after 73 days were few for satisfactory statistical analysis. The returns were classified into 20-day class intervals and subjected to analysis by chi-square.

The conclusions obtained from the results of this study are that a) in routine artificial breeding operations, a greater proportion of returns fall within 11-31 and 32-52 day intervals, regardless of the kind of the extender used. After 52 days the percentage of returns declined sharply; b) the frequency distribution of returns of fluid semen extended in egg-yolk citrate was significantly different from those of semen extended in milk. Milk as a semen extender was observed to have greater percentage of delayed returns than egg-yolk citrate; c) sires of satisfactory levels of fertility and age of extended semen of one and two days old did not influence the pattern of distribution of returns; d) the frequency distribution of returns with frozen semen significantly differed from that of fluid semen extended in milk but not from fluid semen extended in egg-yolk citrate. Fluid semen extended in milk extender differed from both frozen semen and fluid semen extended in egg-yolk citrate in having greater percentage of "delayed returns"; e) egg-yolk citrate was the most desirable extender for freezing semen and yolk-glucose-glycine was unsatisfactory as an extender for freezing semen; f) equilibration time of 4 hours, 8 hours and 12 hours duration in the process of freezing, type of containers either glass or plastic ampules for storing frozen semen and the method of addition of glycerol regardless of the time and temperature had no effect on the frequency distribution of returns; g) frozen semen stored for 18 months was observed to have greater number of delayed returns as compared to fluid semen extended in egg-yolk

citrate and in milk; h) higher percentage of spermatozoan concentration in the frozen semen showed a greater percentage of delayed returns than lower spermatozoan concentration; i) it is recommended that those studies be continued with bulls of different levels of fertility and their influence on frequency distribution of returns be explored; investigation be instituted to explore the possible effects of extenders on early embryonic mortality in artificial breeding.

Microfilm $2.00; Xerox $6.40. 133 pages.

AGRICULTURE, FORESTRY & WILDLIFE

DIAMETER GROWTH OF NORTHERN RED OAK, WHITE ASH, AND HARD MAPLE AS RELATED TO SITE AND SOIL CHARACTERISTICS IN OHIO WOODLOTS.

(L. C. Card No. Mic 59-2703)

Winston Reeves Anderson, Ph.D.
The Ohio State University, 1954

Northern red oak (Quercus rubra var. borealis Michx. f.), white ash (Fraxinus americana Marsh.), and hard maple (Acer saccharum L.) were selected for study and attempts were made to correlate diameter growth with soil and site characteristics. All three species are of vital importance in the central hardwood region of the United States because of their frequent occurrence and their leading positions in the hardwood forest industries.

The research involved 34 experimental woodlands located throughout the state of Ohio. These woodlands were managed by the author and Mr. J. W. Meteer while they were members of the research staff of the department of Forestry of the Ohio Agricultural Experiment Station, Wooster, Ohio (State Project Number 136). At least 20 per cent of the woodland area in each of the experimental forests has been included in permanent one-fifth acre growth and study plots. The woodlands have averaged five to six years growth since plot establishment.

Only dominant and codominant trees of good or excellent vigor were used in growth determinations in the course of the study; 2,350 trees located on 500 study plots were selected. 182 soil pits were dug and about 550 soil samples collected, plus other data concerning the numerous site and soil factors.

Growth data were plotted for the three species by one inch diameter sizes. These inferred curves illustrate the nature of diameter growth by diameter size as well as the growth potential of each species in relationship to the other two species studied. Based on this relationship, northern red oak has a high growth potential, and hard maple has a low potential, while white ash is intermediate in this respect. In reference to the growth curves and growth potential, individual trees may exceed or fall below these averages, depending largely on the site where such trees occur.

In the course of the study it was found that annual diameter growth is not necessarily related to height growth or quality, factors which also vary with soil and site conditions.

Besides the more obvious differences in frequency of occurrence or species distribution, all three species varied in diameter growth by exposure, growth rates being greater on essentially level sites or on the north, east, and northwest-facing slopes. This variation in annual diameter growth by exposure was less for northern red oak, however, than for the other two species.

Annual diameter growth was greater in coves and on lower slopes for hard maple and white ash, although white ash grew equally well in well-drained bottomlands. Northern red oak made about equally good diameter growth on upper slopes as on other topographic locations if the soil was not excessively shallow or the topography too steep.

Northern red oak made the best annual diameter growth on sites of good drainage and the poorest on sites classified as excessively drained. Neither white ash nor hard maple occur on sites of excessive drainage. Where hard maple and white ash of good vigor were dominant or codominant in the forest stand, surface drainage appeared to have little effect on annual diameter growth.

Length of slope appeared to be far more critical for annual diameter growth for the three species than did per cent of slope, except on excessive slope with shallow soils.

A correlation was noted between depth of organic soil (A_1) and the diameter growth of white ash and northern red oak; growth in diameter increasing with depth of A_1. Diameter growth of hard maple showed less correlation than the other two species, except in the lower ranges.

A definite correlation was observed between fines (silt plus clay) in the "B" horizon and diameter growth for all three species, while white ash was the least affected by the amount of clay (alone) in the subsoil. Hard maple made the best growth in loam soils which have a high silt content, while both hard maple and northern red oak diameter growth rates dropped off rapidly in soils with more than 35 per cent clay in the B horizon.

Studies indicated that the type of humus layer was more important to the diameter growth of the three species than the per cent of organic matter or the depth of the organic layer.

Soil reaction or pH was observed to be insignificant in relation to annual diameter growth, although soil reaction was noticeably higher where white ash trees were numerous.

Little correlation was noted between annual diameter growth of northern red oak and white ash with regard to structure of the B horizon, although hard maple showed a definite correlation, with much slower diameter growth measured on heavy subsoils with either a massive or cloddy structure.

Northern red oak showed little correlation in diameter growth with increased soil compaction ("A" horizon). White ash, however, showed a definite trend, with a steady decrease in diameter growth with increase in degree of compaction. Hard maple made the best diameter growth on topsoils classified as mellow in tilth, and decreased with increased compaction.

In Table I is a summary of diameter growth evaluation for the three species studied with reference to soil and site factors.

Table I

Soil and Site Factors	Hard Maple	Northern Red Oak	White Ash
Exposure	Best on none, N, NE, and NW	Not critical	Best on none, N, and NE
	Poor on S and SW		Poor on S and SW
Topography	Best on narrow bottoms, coves, and lower slopes	Best on upper and lower slopes	Best on narrow bottoms, coves, and lower slopes
	Not present on ridge tops and upper slopes	Poor on ridge tops and steep upper slopes	Not present on ridge tops and upper slopes
Drainage	Not critical	Best on good drainage	Not critical
	Not present on excessive drainage	Poor on excessive and poor drainage	Not present on excessive drainage
Depth of A_1	Best at app. 1½-2"	Best at 9-9½"	Best at 5-5½"
	Poor under ½" or over 4½"	Poor under 1½"	Poor under 4" or over 8"
Per cent of Silt plus Clay in B	Best at 80-85%	Best at 70-80%	Best at 55-65%
	Not present under 45%	Not present under 35%	Not present under 45%
Per cent of Clay in B	Best at 25-35%	Best at 25-35%	Best at 25-35%
	Not present under 5% or over 65%	Not present under 15% or over 65%	Not present under 15% or over 65%
Organic Matter Content	Not critical	Not critical	Not critical
pH	Not critical	Not critical	No correlation with diameter growth but higher on ash sites than elsewhere
Soil Structure of B	Best on granular and nut	Not critical	Not critical
	Poor on massive and cloddy	Lower on cloddy and single grain	
Soil Consistency of A	Best on mellow	Not critical	Best on loose
	Poor on compact		Poor on compact

Microfilm $2.00; Xerox $4.00. 74 pages.

Abstract published by special arrangement with The Ohio State University.

AGRICULTURE, PLANT CULTURE

THE CONTROL OF JOHNSONGRASS (SORGHUM HALEPENSE L. PERS.) BY HERBICIDES AND CULTURAL PRACTICES.

(L. C. Card No. Mic 59-2708)

Evert Oakley Burt, Ph.D.
The Ohio State University, 1954

Johnsongrass is one of the worst weeds with which farmers have to contend on fertile soils throughout the central and southern parts of the United States, especially in the cotton and sugarcane producing areas. It is also a serious pest on rich alluvial soils where corn is the principal crop at least as far north as the 40th parallel. Ordinary tillage often seems to do little more than invigorate the grass. Johnsongrass produces an extensive system of rhizomes with large food reserves. These rhizomes send up shoots from axillary buds at the nodes, thus producing new plants. Cultivation of intertilled crops may break the rhizomes into segments, and each segment is a potential Johnsongrass plant. In addition, Johnsongrass produces an abundance of seed, which is readily disseminated by flood waters. Some of the seeds may remain viable in the soil for several years. The seedlings, as well as plants from the previous year's rhizomes, become established in corn hills and cannot be removed however intensively the corn is cultivated.

Eradication of Johnsongrass on river bottoms that are subject to frequent flooding does not seem feasible except as a watershed project. The loose, fertile, alluvial soils which are planted to corn are almost ideal for the growth of Johnsongrass, and once the farm is contaminated with seed, new plants may arise from dormant seeds.

Consequently, the problem in these soils is mainly that of controlling Johnsongrass to the extent that corn yields are not reduced excessively. Methods for the eradication of Johnsongrass on land that is not subject to flooding have been recommended for more than 30 years. The increasing number of acres being abandoned to Johnsongrass is evidence that current control measures do not meet the needs of the areas affected.

The experiments reported here are field studies to evaluate certain herbicides and cultural practices when used alone and in different combinations, at several stages of growth, for the control of Johnsongrass. Supplemental work on the movement and persistence of CMU in different soils was also carried out. The experiments were conducted on natural infestations of Johnsongrass near Chillicothe, Ohio. The normal development of the grass was studied because such knowledge is essential in planning control measures.

Longevity of Johnsongrass Seed. — No studies of the longevity of Johnsongrass seed in the soil were found in the literature. An experiment was initiated in 1951 in which freshly harvested seed from a natural infestation of Johnsongrass was placed in 5-inch porous clay pots with porous clay covers. Four hundred seeds were placed in each of 18 pots. These were buried at 3 different depths so that the seeds were 4 to 6 inches, 7 to 9 inches, and 16 to 19 inches below the surface of the soil. Pots were removed and germination tests were conducted in the fall of 1952 and 1953. The percentage of Johnsongrass that germinated is given in Table 1. These data definitely indicate that Johnsongrass seeds that are plowed under may be a source of reinfestation for several years.

Table 1. Germination of Johnsongrass seed buried in the soil.

Depth buried	Germination after	
	12 months	24 months
Inches	Percentage	Percentage
4-6	24	26
7-9	60	27
16-19	81	49

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

Combined Chemical and Cultural Practices for Control of Johnsongrass. — The field used for the 1951-1952 experiments had been in corn for two years. The infestation of Johnsongrass was uniformly severe both years. The 1951 corn crop yielded about 27 bushels per acre. Sodium trichloroacetate (TCA), sodium chlorate, and polyborchlorate were applied at different rates in September, October, and November of 1951. One-half of each plot was plowed prior to treatment; the other one-half was plowed the following spring.

The field used for the 1952-53 experiments had been in corn in 1950 and in lightly-grazed Johnsongrass pasture in 1951 and 1952. TCA and chlorate were applied in mid-September and mid-October, 1952, to land that was plowed July 30, August 20, September 10, 1952, or March 21, 1953.

When no herbicides were used, the earlier after June 1 the Johnsongrass was plowed the better the control. Plowing July 30 and working the soil frequently enough thereafter to prevent more than 8 to 10 inches of top-growth resulted in satisfactory control (84 per cent) of plants from rhizomes. Plowing three weeks later resulted in only 50 per cent control. Plowing later in the season gave still less control.

When using herbicides, plowing before applying herbicides consistently gave better results than when the land was not plowed. Applications of herbicides in September were more effective than those made in October, and these in turn were more effective than those made in November. Minimal dosage for summer or fall applications was 40 pounds per acre of TCA or 100 pounds of sodium chlorate. Higher rates were necessary if Johnsongrass was not weakened by pasturing or mowing or if the land was not plowed prior to treatment. March applications of TCA at the rate of 20 pounds per acre gave very good control of Johnsongrass from rhizomes and permitted the production of a corn crop that year if planted 60 days after treatment. March applications of sodium chlorate were effective in controlling Johnsongrass, but the residual toxicity prevented the production of a corn crop the same year. A positive correlation between the effectiveness of the herbicides and the precipitation pattern following treatment was demonstrated. Optimum control of Johnsongrass by the use of TCA and sodium chlorate was obtained when sufficient rainfall occurred soon after application to leach the herbicides into contact with the rhizomes, but there was no control below this zone.

Sodium chlorate was not leached from the soil during the unusually dry winter of 1952, resulting in injury to the 1953 corn crop. Polyborchlorate at rates of 100 to 400 pounds per acre injured corn severely and was ineffective in controlling Johnsongrass.

Control of Johnsongrass in Established Alfalfa. — These cultural practices require taking the land out of production for a season. It might be more economical to eradicate Johnsongrass in a growing crop. Two herbicides, TCA and sodium 2,2-dichloropropionate (Dalapon), give promise of use as selective herbicides in alfalfa-Johnsongrass mixtures. Under favorable conditions these herbicides controlled Johnsongrass without permanent damage to alfalfa. Ten pounds per acre of Dalapon or 20 pounds per acre of TCA applied immediately after the first cutting gave the most satisfactory results. Five pounds per acre of Dalapon or 10 pounds per acre of TCA gave good control of Johnsongrass in the second cutting and, while not tried, these rates applied after both the first and the second cutting might be preferable because of less injury to alfalfa, and possible control of seedlings in wet summers.

Applications of Maleic Hydrazide (MH) to Established Johnsongrass. — MH at rates of 4 to 64 pounds per acre was applied to Johnsongrass at different stages of growth and the land was either plowed or left undisturbed. The application of MH to young Johnsongrass foliage followed by plowing in a few days gave effective control. The 12-pound rate, plowed 3 days after treatment, gave 83 per cent control. No effective control was obtained when the stand was plowed 20 days after treatment or not plowed at all.

Control of Johnsongrass Seedlings. — Preparing land for corn the first week in May and refitting the land a month later gave sufficient control of Johnsongrass from both rhizomes and seed to permit the production of a late crop of corn. In 1952, 2,4-D applied pre-emergence to corn at rates of 2 and 4 pounds per acre gave 64 and 83 per cent control, respectively, of Johnsongrass seedlings, with no visible damage to the corn.

CMU for Control of Johnsongrass and Persistence of CMU in Soils. — Experiments were started in 1951 and 1952 to determine (1) the feasibility of controlling established Johnsongrass by the use of 3-*p*-chlorophenyl-1,1-dimethylurea (CMU) and (2) the persistence of CMU in soils.

Eighty pounds per acre of CMU (pure material) almost eradicated Johnsongrass. These plots were free of all vegetation except for a few stunted Johnsongrass plants 2½ years after treatment. The 60-pound rate gave 78 per cent control. Plots treated at the 40-pound rate contained about the same amount of Johnsongrass as the untreated plots, and plots treated at the 20-pound rate contained 10 per cent more Johnsongrass than the untreated plots. The greater growth of Johnsongrass in plots treated at the 20-pound rate was attributed to the complete control of all weeds except Johnsongrass.

CMU was present in quantities lethal to soybeans at a depth of 20 to 24 inches two years after treatment with 64 pounds per acre of CMU.

SUMMARY

1. Johnsongrass seeds buried in soil germinated 26 to 49 per cent after 2 years.

2. The effectiveness of both herbicides and cultural practices was related to the root reserves of Johnsongrass at the time of treatment. Plants weakened by pasturing or mowing were more easily controlled.

3. When Johnsongrass had been weakened by pasturing, plowing in July by disking to prevent more than 8 to 10 inches of top-growth reduced the stand of Johnsongrass the following year 84 per cent. Plowing later in the summer or in the fall was progressively less effective.

4. Plowing prior to treatment consistently increased the effectiveness of sodium trichloroacetate (TCA) and sodium chlorate applied in the summer or fall.

5. The effectiveness of TCA and sodium chlorate was associated with the amount and distribution of rainfall following treatment. Optimum control was obtained when enough rainfall occurred to leach the herbicides into the upper 6 to 8 inches of the soil, but there was no control below this zone.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

6. Minimal dosage for summer or fall applications was 40 pounds per acre of TCA or 100 pounds per acre of sodium chlorate. Higher rates were necessary if Johnsongrass was not weakened by pasturing or mowing or if the land was not plowed prior to treatment. Polybor-chlorate was definitely ineffective at rates of 100 to 400 pounds per acre and was seriously toxic to corn the year following treatment.

7. March applications of TCA at the rate of 20 pounds per acre gave very good control of Johnsongrass and permitted the production of a corn crop the same year if planted 60 days after treatment.

8. The application of maleic hydrazide to young Johnsongrass foliage followed by plowing in a few days gave effective control. The 12-pound rate gave 83 per cent control when the stand was plowed three days after treatment. No effective control was obtained when the stand was plowed 20 days after treatment or not plowed at all.

9. 2,4-D applied pre-emergence to corn at rates of 2 and 4 pounds per acre gave 64 and 83 per cent control respectively of Johnsongrass seedlings, with no visible damage to the corn.

10. Preparing land for corn the first week in May and refitting the land a month later gave sufficient control of Johnsongrass from both rhizomes and seed to permit the production of a later crop of corn.

11. Selective control of Johnsongrass in alfalfa-Johnsongrass mixtures was obtained by applying sodium 2,2-dichloropropionate (Dalapon) and TCA. Under favorable conditions Johnsongrass was controlled without permanent damage to alfalfa. Dalapon at the rate of 10 pounds per acre and TCA at the rate of 20 pounds per acre gave the most satisfactory results.

12. Eighty pounds per acre of 3-*p*-chlorophenyl-1,1-dimethylurea (CMU) almost eradicated Johnsongrass. These plots were free of all vegetation except for a few stunted Johnsongrass plants 2½ years after treatment.

13. CMU was present in soil at a depth of 20 to 24 inches in quantities lethal to soybeans 2 years after treatment with 64 pounds per acre of CMU.

Microfilm $2.05; Xerox $7.40. 156 pages.

Abstract published by special arrangement with The Ohio State University.

THE ACCUMULATION OF SOME MINOR ELEMENTS IN CORN PLANTS GROWN AT DIFFERENT LEVELS OF HYDROGEN-ION CONCENTRATION

(L. C. Card No. Mic 59-2549)

Yuan-Pin Chou, Ph.D.
The Ohio State University, 1954

Introduction

Mineral accumulation in plants has been studied at the Ohio Agricultural Experiment Station for many years. Included in this study is an investigation of the accumulation of minor elements in leaves and the related toxicity and deficiency symptoms. It has been known that deficiencies of minor elements often occur in sandy loam soil under heavy liming, while toxicity due to an excess of an element is generally found in acid soils. It is obvious that the soil reaction influences the uptake of minor elements and in turn causes the deficiency or toxicity symptoms.

The present work involved an investigation of the accumulation and distribution of some minor elements in the corn plant at various pH levels of the medium. Fifteen mineral elements were investigated, twelve of which were minor elements. No attempt was made to study the total mineral absorption by the plant or to correlate it with any other specific symptoms.

Methods and Materials

Three years work (1951-1953) was carried out at the Ohio Agricultural Experiment Station, Wooster, Ohio. The radioactive tracer elements and the spectrograph were used to determine the elements. Of the fifteen mineral elements, zinc, cobalt, strontium, and iron were obtained in radioactive form from the Oak Ridge National Laboratories. The other elements were analysed by the spectrographic method.

Corn was grown in gravel, solution, and soil cultures at three pH levels. In addition, corn samples were taken from the field and from one set of gravel cultures grown at high and low concentrations of minor elements. The method of growing corn in gravel cultures with subirrigation was that described by Sayre.[1] For solution cultures, 5-gallon wooden kegs were separated into two compartments by hardware cloth and plastic screen. In the upper compartment 2½ inches of gravel were placed to support the plant. The irrigation was controlled by a mercury switch and a float which was put into a 3-gallon pot. The cycle of irrigation was of 15 minutes duration, 5 minutes for irrigating and 10 minutes for draining. Three-gallon glazed pots were used for the soil cultures. The moisture of the soil was kept near field capacity by weighing the pots and adding water. All cultures were kept in the greenhouse except the gravel cultures in 1951 and 1952 and the soil cultures in 1953, which were set outdoors.

The desired pH level of the solutions was obtained by varying the nitrate-ammonium ratio, and was adjusted when necessary with normal sulfuric acid or potassium hydroxide solution. The pH of each culture was determined twice each day. The pH of the soils used was raised by adding lime to soil of pH 5.5 and incubating under field capacity. The soils used were Wooster silt loam, Mahoning silty clay loam, and Fincastle silt loam. The soil in which the field corn grew has been adjusted to pH 5.8 and pH 6.7 in two plots for more than 25 years.

Radioactive isotopes were introduced into the corn cultures about one week after tasselling, because from this time to the ripening stage corn absorbs various elements more rapidly. The corn was harvested three or four weeks after addition of the radioactive isotopes to the culture medium.

A summarized description of each experiment is given in Table I.

Summary of Results

1. In all cultures, generally, the lower the pH, the more accumulation of minor elements occurs in the plant. At the three pH levels used in soil cultures, most of the minor elements accumulated in the lower and dead leaves.

2. The location of accumulation of a minor element is influenced by the characteristics and concentration of the

element, the age of the plant, and other factors which affect plant growth. In general, when the plant is young, more minor elements accumulate in the upper portion of the plant. As it grows older, the accumulation of minor elements shifts to the lower leaves. In etiolated or dead leaves, all minor elements are concentrated in the margins. The degree of burning of leaf margins is correlated with the amount of minerals accumulated.

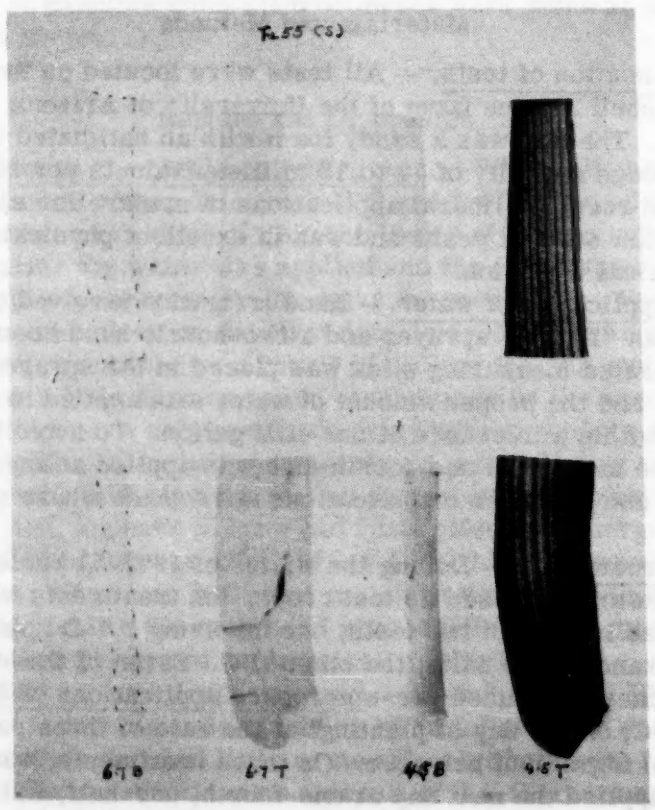
Table I

Treatments of the Experiments, 1951-1953.

Year	Culture	Location	Variety	Plants per Pot	Replicates	pH Levels	Material Added per Pot	Elements Studied
1951	gravel	outdoors	W 64	1	1	6.7, 5.5-4	Zn^{65}, 0.136 mc.	Zn^{65}
1952	gravel	outdoors	W 64	1	1	7, 5.5, 4	3 pots, Zn^{65}, 0.6 mc. 3 pots, Co^{60}, 0.51 mc. 3 pots, Sr^{89}, 0.96 mc. 2 pots, Fe^{55}, 0.33 mc.	Zn^{65}, Co^{60}, Sr^{89}, Fe^{55}
1952	solution	green-house	W 64	2	1	7, 5.5, 4	3 pots, Zn^{65}, 0.6 mc. 3 pots, Co^{60}, 0.51 mc. 3 pots, Sr^{89}, 0.96 mc. 2 pots, Fe^{55}, 0.33 mc.	Zn^{65}, Co^{60}, Sr^{89}, Fe^{55}
1953	3 soils	outdoors	K 14 K 24	1	3	7.5, 6.5, 5.5	10-10-10, 500 lbs./A	B, P, Mn, Fe, Pb, Si, Al, Cu, Zn, Mg, Ca, Ag, Sn
1953	1 soil	outdoors	K 24	1	1	7.5, 6.5, 5.5	10-10-10, 500 lbs./A 3 pots, Zn^{65}, 1 mc. 3 pots, Co^{60}, 0.9 mc.	Zn^{65}, Co^{60}
1953	1 soil	field	W 64	-	3	6.7, 5.8	----	B, P, Mn, Fe, Pb, Si, Al, Cu, Zn, Mg, Ca, Ag, Sn
1953	gravel	green-house	K 24	2	2	7, 6, 5	low and high levels of minor elements*	B, P, Mn, Fe, Pb, Si, Al, Cu, Zn, Mg, Ca, Ag, Sn

*(1) Low Fe, Mn, Zn, Cu, B, Co, Mo treatment: omit each element in the minor element mixture.
(2) High level treatment, Fe, 90 p.p.m.; Mn, 37.5 p.p.m.; B, 12.5 p.p.m.; Zn, 3.75 p.p.m.; Cu, 0.6 p.p.m.; Co, 0.3 p.p.m.; Mo, 0.3 p.p.m.

Fig. 1. Fe^{55} accumulation in corn leaves at pH 6.7 and 4.5 (solution culture, 1952).



Remarks: (1) The left side of each leaf section is the leaf margin, the right is the side attached to the midrib.
(2) For both pH levels, T is No. 4 leaf and B is No. 12 leaf.
(3) Middle sections sampled on Aug. 17, 1952; basal sections sampled on Aug. 22, 1952.
(4) Dotted lines indicate the edge of the leaf section.
(5) Exposure, 28 days.

The elements investigated in the study may be classified into three groups:

A. The elements which always accumulate in leaf margins or in the tips of other organs. Cobalt, boron, and silicon belong to this group.

B. Those which usually accumulate in the leaf margins but may also accumulate in nodes when the concentration is high or under certain other conditions. Manganese, iron, copper, and probably aluminum are included in this group.

C. Those which usually accumulate in nodes but may accumulate more in leaf margins under unfavorable growth conditions. Zinc, calcium, strontium, and magnesium belong to this group.

In the old or etiolated leaves, all mineral elements accumulate in the margins, especially in the lower leaves.

3. The lower the pH, the more zinc accumulates in the corn plant, although the difference between pH 5.5 and pH 4 is not great. Zinc accumulation increases with increase in concentration of zinc in the substrate. The yield of grain is increased by increasing the uptake of zinc.

Nodal accumulation of zinc was found in all cultures except the field corn. The nodes of the shank have the highest amount of zinc. In the tops, the upper part of the plant usually contains more zinc than the lower, but zinc may accumulate more in the lower leaves when supplied abundantly. In the grain, zinc accumulates in the embryo.

4. In the tops of the corn plants, cobalt always demonstrates marginal accumulation, especially in the upper leaves. The lower nodes and nonmarginal portions of the lower leaves contain more cobalt than the corresponding upper parts.

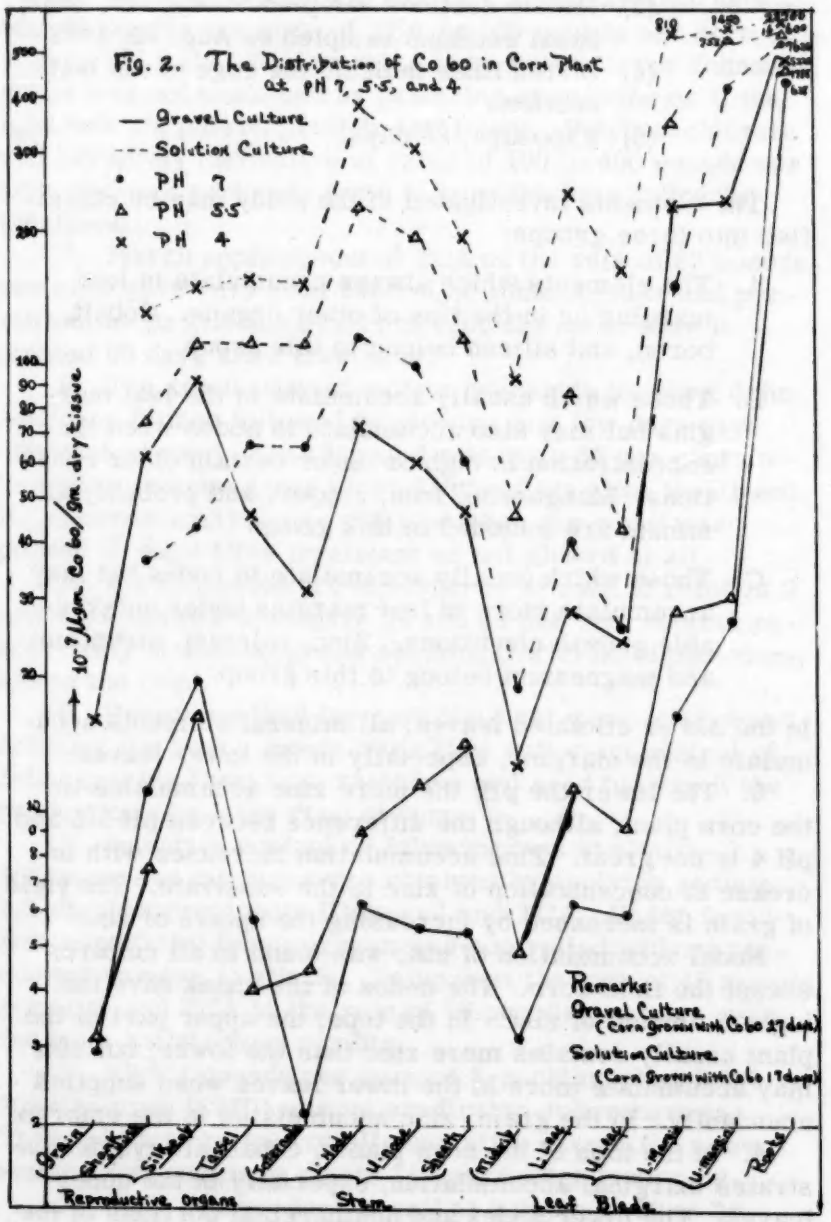
As is shown in Figure 2, corn grown in solution cultures with Co^{60} contains more Co^{60} than that grown in gravel cultures for a 10-day longer period. This is probably caused by the frequent irrigation and by the large amount of cobalt in available form.

In the gravel and solution cultures, lower pH favors more absorption of cobalt. In the soil, cobalt accumulates less at pH 6.5 than at either pH 7.5 or pH 5.5. This may be caused by the precipitation or by some sort of fixation of cobalt chloride around pH 6.5. When the concentration of cobalt is very low in a nutrient solution of pH 6.5, the dry weight of the corn is reduced to such an extent that cobalt may be considered as a necessary element in the healthy growth of corn.

5. Strontium, calcium, and magnesium act similarly. They accumulate in nodes more than in leaf margins, though ordinarily they are uniformly distributed in leaves. High calcium concentration in soil decreases the accumulation of magnesium in corn plants, and vice versa. Strontium is absorbed in less amount at pH 5.5 than at either pH 7 or 4. Besides the roots and stem, the midrib and tassel contain a considerable amount of strontium. In the grain, strontium is accumulated in the basal portion including the embryo and the point of attachment to the cob.

6. In gravel and solution cultures iron accumulates

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more in nodes. But in soil cultures iron accumulates in the leaf margins and not in the nodes. In the grain, iron accumulates in the embryo.

7. Boron always accumulates more in leaf margins, especially towards the tip of the leaf. Boron is toxic at 12.5 p.p.m. in nutrient solution. The toxicity symptoms are nocturnal exudation of a white substance, burning of leaf margins, chlorosis along the veins, and the yellowing of young leaves. Dry weight of both roots and tops is reduced. In the leaf margins there accumulates a large amount not only of boron, but also of other minor elements such as iron, manganese, silicon, aluminum, and zinc. However, accumulation of calcium and copper is reduced.

8. Manganese accumulated in leaf margins, especially at lower pH levels. Increasing the amount of manganese in the nutrient solution decreased the accumulation of iron in leaf margins.

9. Copper at a concentration of 0.6 p.p.m. in nutrient solution did not injure the growth of corn. The copper usually accumulated in the leaf margins, but sometimes it was uniformly distributed and in other cases it accumulated in the nodes. When the iron, zinc, or molybdenum concentration was very low in the nutrient solution, accumulation of copper in leaf margins was greatly increased.

10. Silicon always accumulates in leaf margins. Aluminum accumulates in margins, but nodal accumulation was not found in any cultures. The distribution of lead in corn is very irregular; a considerable amount accumulates in the tassel silk, and grain. Tin was also found in the grains and tassel. Silver occurs in every part of the corn plant, and is most abundant in the upper nodes and leaf margins. Microfilm $2.00; Xerox $6.20. 126 pages.

1. Sayre, J. D. "Accumulation of radioisotopes in corn leaves," Ohio Agr. Expt. Sta. Res. Bull. 723 (1952). pp. 3-6.

Abstract published by special arrangement with The Ohio State University.

THE EFFECTS OF IRRIGATION ON THE TOXICITY OF 2,4-D AND IPC APPLIED PRE-EMERGENCE

(L. C. Card No. Mic 59-2550)

Howard Paul Cords, Ph.D.
The Ohio State University, 1954

Pre-emergence chemical weed control is a promising tool in the age-old fight against weeds. Despite efforts of many weed control investigators, however, the method is still highly unpredictable. A large number of factors have been shown to affect the success of such treatments; among the most important of these factors is soil moisture.[1] When water passes through a treated surface layer, the chemical may be leached into the crop seed zone. If too little moisture is present in the surface during the germination of the weed seeds, such treatments are likely to be ineffective in weed control.

In the arid Southwest, where crop production is possible only under irrigation, rainfall at any season of the year is extremely unpredictable and pre-emergence treatments have been generally unsuccessful. The present study investigated the feasibility of the successful use of this method of weed control under irrigation.

Materials and Methods

Location of tests. — All tests were located on the Campbell Avenue farm of the University of Arizona (Tucson). The soil was a sandy loam with an estimated base exchange capacity of 10 to 15 milliequivalents per 100 g. It had received liberal applications of manure for each of the past several years and was in excellent physical and chemical condition.

Application of water. — Hand irrigation involved using a Bean "Estate" sprayer and a two-nozzle hand boom. A calibrated measuring stick was placed in the sprayer tank, and the proper amount of water was applied to each plot within a tolerance of one-half gallon. To avoid run-off, no more than one-fourth inch was applied at any one time and successive applications were made where called for.

Treatments. — During the winter of 1950-51 barley and safflower were used as test crops; ten treatments were applied in each of two tests, one involving 2,4-D applied as alkanolamine salts, the other IPC. Seven of these treatments included pre-emergence applications of 2,4-D or IPC, on the day of planting, at the rate of three pounds active ingredient per acre. On three treatments, water was applied the next day at one-fourth, one-half, and one acre inch per acre. Three others were irrigated at the same rates on the seventh day after planting. The seventh pre-emergence treatment received no water. The three remaining treatments received no herbicide. They consisted of an unwatered check, a check receiving one-half

inch of water the day after planting, and a check receiving one-half inch of water seven days after planting. Each treatment was replicated three times in a randomized complete block design.

During the summer of 1951 a series of treatments similar to those described above was set up in a randomized complete block design with four replications using sorghum as the test crop. 2,4-D was the only herbicide used in this test.

During the winter of 1951-52 two tests similar to those made in 1950-51, except that all one-inch water applications were eliminated, were set up in a randomized complete block design with four replications. One-fourth inch of rain fell the day following planting and application of chemicals, so the early irrigations could not be made. The seventh day applications were made as scheduled. Because of this forced change, the treatments no longer conformed to the original plan. The treatments in each test now were, in addition to one-fourth inch rain on all: (1) two checks, unwatered; (2) one check treatment with one-half inch of water applied seven days after planting; (3) three chemical treatments, unwatered; (4) one chemical treatment with one-fourth inch water applied seven days after planting; (5) one chemical treatment with one-half inch water applied seven days after planting.

Data collected. – On the barley-safflower plots, the data collected were (1) date of emergence; (2) total stand count; (3) grain yield; and (4) seed weight measured as grams per 1000 seeds. In addition, notes were taken on plant growth, injury symptoms and weed control. On the sorghum plots, silage yields in pounds of green material per plot were the only data collected.

Histological studies. – Samples for histological studies were collected from the barley-safflower plots during 1950-51. Longitudinal sections of the apical growing points of samples from all treatments were made at three growth stages.

Results and Discussion

Effect of chemicals on emergence. – When followed by irrigation at either date, both IPC and 2,4-D delayed the emergence of barley. Within the limits of this experiment, the earlier the water was applied and the more water that was applied, the greater the delay in emergence. Water applications alone on the first date delayed emergence of this crop, probably as a result of cooling the soil and forming a light surface crust. Irrigations on the second date resulted in only one day's delay with or without 2,4-D treatment. IPC resulted in nearly as much slowing of emergence following the second date of irrigation as the first. IPC appears to have had little effect on emergence of safflower, but the effect of 2,4-D on this crop was severe. Whenever sufficient moisture was added to carry the chemical to the crop seed zone, safflower emergence was either prevented or drastically delayed.

Effect on chemicals on stand. – Both 2,4-D and IPC caused reduced stands of barley when followed by water applications, but had little or no effect without such additions. Stand reductions as a result of 2,4-D treatment appeared to be greater when water was applied immediately after planting rather than seven days after, but the differences were too small for statistical significance.

IPC treatments did not significantly reduce stands of safflower in 1950-51, but there was a reduction from IPC plus one-half inch water in 1951-52. 2,4-D caused severe stand reductions under all circumstances.

Table I

Effect of 2,4-D and IPC on Emergence of Barley and Safflower. (Planted and chemicals applied December 21, 1950)

	Number of Days from Planting to Emergence			
	Barley		Safflower	
	IPC	2,4-D	IPC	2,4-D
1. Check, no treatment	12	12	18	17
2. Check, ½" water Dec. 22	15	15	20	20
3. Check, ½" water Dec. 28	13	13	19	20
4. Chemicals, no added water	12	12	17	16
5. Chemicals, ¼" water Dec. 22	15	13	18	29
6. Chemicals, ½" water Dec. 22	16	16	20	32
7. Chemicals, 1" water Dec. 22	17	18	20	--*
8. Chemicals, ¼" water Dec. 28	13	12	20	30
9. Chemicals, ½" water Dec. 28	14	13	20	34
10. Chemicals, 1" water Dec. 28	16	13	20	29
Least significant difference (.01)	1.9	1.4	1.6	1.8

*No emergence.

Table II

Effect of 2,4-D and IPC on Stands of Barley and Safflower. (Planted and chemicals applied December 21, 1950)

	Average Number of plants per 6-ft. row			
	Barley		Safflower	
	IPC	2,4-D	IPC	2,4-D
1. Check, no treatment	78	90	106	118
2. Check, ½" water Dec. 22	65	72	93	104
3. Check, ½" water Dec. 28	67	87	95	111
4. Chemicals, no added water	61	76	117	10
5. Chemicals, ¼" water Dec. 22	34	62	99	3
6. Chemicals, ½" water Dec. 22	25	56	71	1
7. Chemicals, 1" water Dec. 22	18	60	85	0
8. Chemicals, ¼" water Dec. 28	43	67	102	3
9. Chemicals, ½" water Dec. 28	35	75	97	2
10. Chemicals, 1" water Dec. 28	17	65	72	7
Least significant difference (.01)	25	21	N.S.	S.

Effects of chemicals on growth. – Both 2,4-D and IPC caused seedling abnormalities in barley. IPC symptoms were similar to those reported by Ennis[2,3] working with the oat. The coleoptile became much thickened and failed to elongate normally; roots were similarly affected. Histological examination revealed an almost complete inhibition of cell division and enlargement of all cells capable of further growth (see Fig. 3). These symptoms were most prominent in plots receiving one inch of water immediately after planting and chemical application. After emergence, plants on IPC treated plots had shorter, broader leaves than those on untreated plots.

2,4-D symptoms in barley were similar to those described by a large number of workers. Histological observation revealed a slight inhibition of the apical growing point (see Fig. 2) and roots were severely inhibited. "Onion leafing" was prominent during all stages up to heading and growth appeared to be retarded. Abnormal spikes were frequent in 1950-51 but none were observed in 1951-52.

IPC appeared to have no effect on the growth of safflower, but 2,4-D symptoms were so severe that few plants survived. Histological examination revealed an enlargement of the radicle caused by enlargement of cells in the cortical parenchyma and meristematic activity which originated in the pericycle (Figs. 6, 7, and 8). In

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plants from plots irrigated the day after planting, this swelling was restricted to the root hair zone and an area slightly above it (Fig. 6). Plants from plots irrigated seven days later showed a more diffuse swelling of the radicle. In both cases the apical growing point was severely inhibited, but no abnormal growth was apparent (Fig. 5).

Effects on grain yield. – In 1950-51, 2,4-D treatments reduced the yield of safflower from 385 grams per plot (average of checks) to 100 grams per plot (average of 2,4-D treated), and in 1951-52 no plants survived to maturity on 2,4-D treated plots. The effect of this chemical on yield of barley was less evident. The check treatments averaged 427 grams, 2,4-D treatments with late irrigations 485 grams, and 2,4-D treatments with early irrigation 372 grams. The reduction in yield is significant. In 1951-52 also, 2,4-D produced a significant yield reduction. Treatment with IPC did not reduce the yields of either barley or safflower in either year.

Treatment with 2,4-D followed by irrigation soon after planting reduced the silage yield of sorghum. Such treatment with water applied a day or two after emergence had no apparent effect on this crop.

Effects on seed weight. – None of the treatments involved had any significant effect on weight per 1000 seeds of barley or safflower.

General discussion. – Since even one-fourth acre inch irrigations were sufficient to carry 2,4-D as an amine salt to the crop seed zone of safflower and almost destroy that crop, it seems that the use of flood irrigation to make pre-emergence herbicidal treatments effective is not practical. Small amounts of water cannot be uniformly applied by that method. If at some future date, an effective pre-emergence herbicide is found that will not move in the soil, flood irrigation may be practical for this purpose.

Summary and Conclusions

1. Five tests were carried out to determine the practicality of using irrigation water to produce the proper soil moisture conditions for successful pre-emergence weed control treatments.
2. Three pounds 2,4-D per acre followed by irrigation delayed emergence of both barley and safflower.
3. Three pounds IPC per acre followed by irrigation delayed the emergence of barley one or two days but had little effect on time of emergence of safflower.
4. Three pounds 2,4-D per acre followed by irrigation almost eliminated stands of safflower. Barley stands were slightly reduced by these treatments.
5. Three pounds IPC per acre followed by irrigation reduced barley stands 50 to 75 per cent. The same treatment reduced safflower stands 0 to 50 per cent.
6. The use of irrigation to produce favorable soil moisture conditions for pre-emergence weed control appears to be feasible only in those instances in which the crop plant has considerable tolerance to the chemical and in which very small amounts of water can be uniformly applied as is possible with sprinkler irrigation.
7. Pre-emergence applications of 2,4-D and IPC had no effect on weight per 1000 seeds of barley or safflower.



Figure 1. Photomicrograph of the apical region of an untreated barley seedling collected 13 days after planting. Note indications of vigorous growth.



Figure 2. Photomicrograph of the apical region of a barley seedling growing in 2,4-D treated soil collected 13 days after planting. In comparison to the untreated plant, there are no tillers started, and the region of rapid growth below the growing point is shorter.

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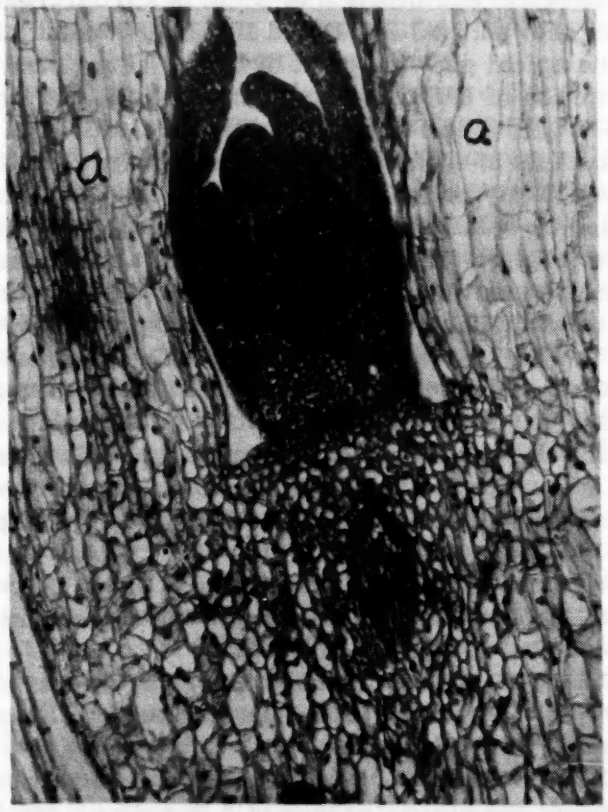


Figure 3. Photomicrograph of the apical region of a barley seedling growing in IPC treated soil collected 27 days after planting. Note complete inhibition of apical growth and enlargement of cells of the coleoptile (a) (a) in comparison to the 2,4-D treated plant.



Figure 4. Photomicrograph of the apical region of a safflower seedling growing in untreated soil. Sample collected 27 days after planting. Note indications of rapid growth.

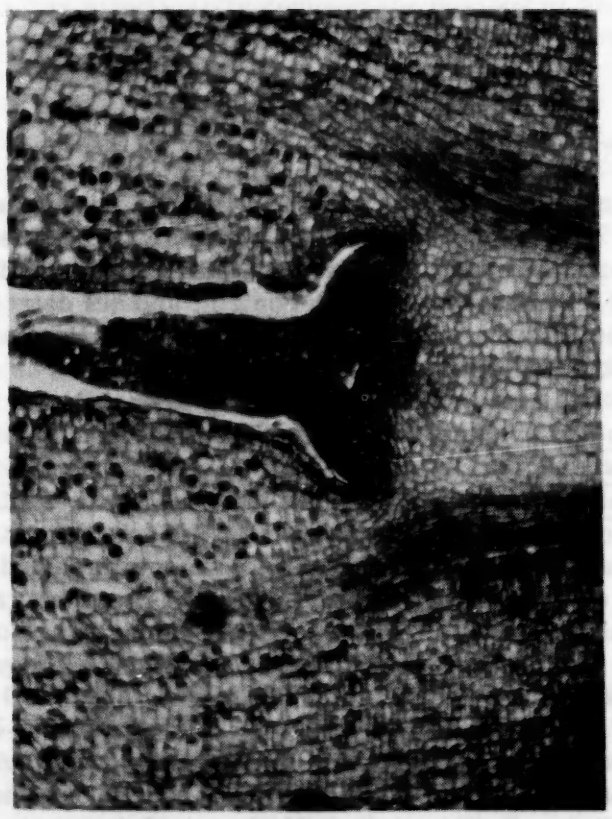


Figure 5. Photomicrograph of the apical region of a safflower seedling growing in soil treated with 2,4-D. Sample collected 27 days after planting. Note complete inhibition of growth.

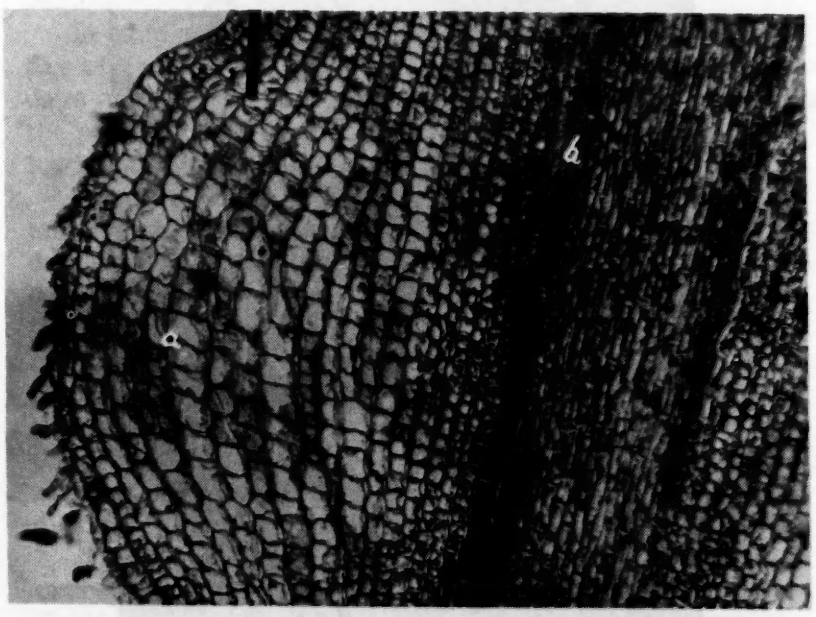


Figure 6. Longitudinal section of the hypocotyl of a safflower seedling growing in soil treated with 2,4-D. Sample collected 7 days after planting. Note the bulbous enlargement (a) due to enlargement of the cortical parenchyma cells and location of the enlarged area with respect to the root hair zone. Note also the beginning of meristematic activity in the pericycle (b).

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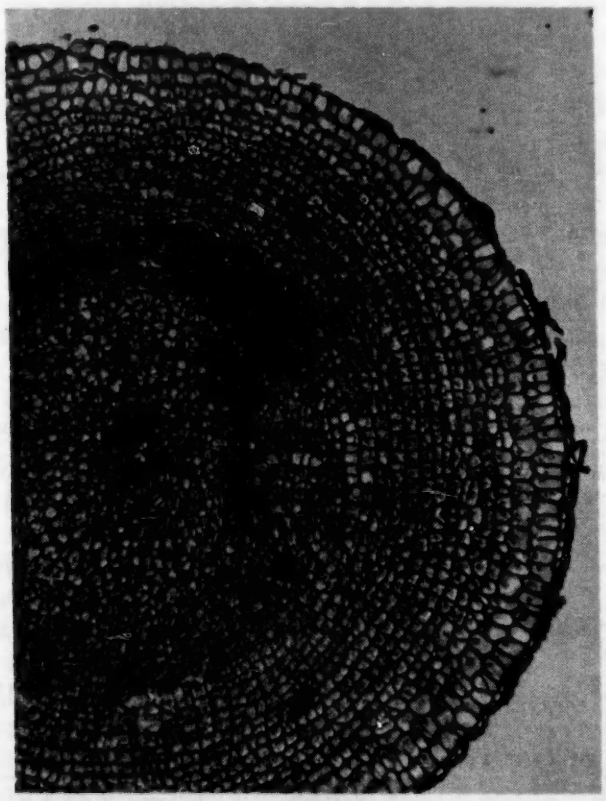


Figure 7. Cross section of the hypocotyl of a safflower seedling growing in soil treated with 2,4-D. Sample collected 27 days after planting. Note evidence of meristematic activity in epidermis (a), and the region surrounding the stele (b).



Figure 8. Longitudinal section of the hypocotyl of a safflower seedling growing in soil treated with 2,4-D. Sample collected 27 days after planting. Note that the proliferated area (b) has resulted in the crushing of the cortical parenchyma cells (a).

8. Histological examination of seedlings from treated plots showed: (A) 2,4-D and IPC both caused inhibition of the apical growing point of barley (Fig. 2 and 3), but the action of IPC was much more drastic than that of 2,4-D. (B) 2,4-D caused abnormal cell division in the hypocotyls of treated safflower seedlings (Fig. 8). This activity began in the pericycle and was accompanied by enlargement of the cortical parenchyma cells (Fig. 6). Epidermal cells were also stimulated to meristematic activity (Fig. 7). (C) 2,4-D caused severe inhibition of the apical growing point of safflower (Fig. 5). (D) IPC caused almost complete inhibition of cell division in severely affected barley seedlings (Fig. 3). This was accompanied by enlargement of all cells capable of further growth. This chemical had no apparent effect on the anatomy of safflower.

Microfilm $2.00; Xerox $3.00. 60 pages.

1. Aldrich, Richard J., and Willard, C. J. "Factors Affecting the Pre-Emergence Use of 2, 4-D in Corn," Weeds, 1 (July, 1952), pp. 338-345.

2. Ennis, W. B. Jr. "Some Cytological Effects of O-isopropyl, N-phenyl Carbamate upon Avena," Amer. Jour. Bot., 35 (1948), pp. 15-21.

3. Ennis, W. B. Jr. "Responses of Crop Plants to O-isopropyl, N-phenyl Carbamate," Bot. Gaz., 109 (1948), pp. 473-493.

Abstract published by special arrangement with The Ohio State University.

INFLUENCE OF BRUSH CONTROL, SEEDING, AND FERTILIZATION ON THE PRODUCTION OF FORAGE IN PASTURES

(L. C. Card No. Mic 59-2766)

Richard John Delorit, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor K. P. Buchholtz

This study was initiated in 1954 to (a) determine the effects of several chemical and mechanical treatments in the control of brush, (b) investigate the influence of seeding and fertilization on brush control, and (c) determine the effect of brush control, seeding, and fertilization on the production of seeded and forb species.

A dense stand of brush consisting primarily of: hazel (Corylus americana), brambles (Rubus strigosus and R. allegheniensis), dogwood (Cornus racemosa), and aspen (Populus tremuloides), covered the trial area. Initial counts of brush stems were made in 1954 and recounts 2 years later. The brush control treatments included (1) check, (2) fall basal, (3) spring basal, (4) stubble, and (5) slash treatments. The fall basal, spring basal, and stubble treatments consisted of 12.5 pounds acid equivalent of a 1:1 mixture of low-volatile esters of 2,4-D and 2,4,5-T ahg of oil. Applications of 200 pounds of 0-0-60, 1200 pounds of hydrated lime, and 3.5 tons of ground limestone were made per acre to 5 of the 10 treatment plots. Strips covering one-half of each plot were spring-seeded with a mixture of alfalfa, timothy, medium red clover, and Ladino clover at a rate of 18 pounds per acre. Two forage cuttings were made annually and the yield calculated in pounds of dry matter per acre. Forb counts

were made in 1956 to determine the effect of brush control, seeding, and fertilization on the number of various forbs compared to the check (untreated plots).

Results indicated a highly significant difference between the three chemical treatments in the control of brambles and hazel. The spring basal treatment had little if any effect on the control of brambles and the stubble treatment produced the poorest control of hazel. Fertilization produced a highly significant reduction of brambles, but resulted in a highly significant increase of hazel resprouts. There were no significant differences in the control of dogwood and aspen between chemical control treatments or between fertility levels. Good control was obtained within all chemical and fertility treatments. Seeding had no significant effect on the control of any species.

Seeding markedly increased the combined grass-legume yields within chemical treatments during each of the three years. Seeding produced a significant reduction of forb yields within the fall basal and stubble treatments over all fertility levels in 1956. Seeding significantly reduced forb yields on fertilized plots within the fall basal treatment, but significantly reduced forb yields on unfertilized plots within the stubble treatment. Forb yields over all chemical treatments in 1957 were significantly higher on the seeded strips of fertilized plots; whereas they were significantly higher on the unseeded strips of unfertilized plots. Seeding produced a highly significant increase in the total yield of herbaceous matter in 1956.

The spring basal treatment significantly reduced grass-legume production in 1955. Fertilization significantly increased forb yields over all seeding and chemical treatments in 1955 and significantly reduced grass-legume yields over both levels of fertility within the seeded areas in 1956.

Seeding significantly reduced the number of violets (Viola sp.). Significant and highly significant increases in the number of asters (Aster sagittifolius, A. lateriflorus), Canada thistle (Cirsium arvense), and goldenrods (Solidago graminifolia, S. altissima) occurred within the fall treatment; sunflowers (Helianthus sp.), bedstraw (Galium aparine), and Canada thistle within the spring treatment; and Canada thistle and goldenrods within the stubble treatment. Significant reductions of hemp nettle (Galeopsis Tetrahit) and sunflowers occurred within the fall treatment; hemp nettle within the spring treatment; and wild geranium (Geranium maculatum) within the stubble treatment. Fertilization produced highly significant and significant increases of wild bean (Phaseolus polystachios) and fringed loosestrife (Lysimachia ciliata).

Microfilm $2.00; Xerox $6.20. 129 pages.

THE MEGAGAMETOPHYTE IN THE SWEET CHERRY PRUNUS AVIUM L. AND ITS RELATION TO FRUIT SETTING.

(L. C. Card No. Mic 59-2736)

George Walter Eaton, Ph.D.
The Ohio State University, 1959

A study of the megagametophyte in Prunus avium was undertaken to determine to what extent delayed development, cytological irregularities, or degeneration might account for failure of this fruit to set commercial crops. Unpollinated Windsor pistils were collected at regular intervals following anthesis in 1957 in the orchard of the Department of Horticulture and Forestry, The Ohio State University, at Columbus, Ohio, and in 1958 in an orchard of the Horticultural Experiment Station, Vineland Station, Ontario. A few Windsor pistils prior to anthesis, pistils hand-pollinated at intervals following anthesis, and open-pollinated flowers, were collected from Windsor and Vista trees in 1958 at Vineland Station, Ontario. Paraffin serial sections were prepared and the contents of the embryo sacs in primary ovules were examined cytologically. Embryo sac development was according to the Polygonum type.

At anthesis in 1957, 91 per cent of the embryo sacs had reached the eight-nucleate stage. Of these 62 per cent had formed an egg cell, all of which were apparently functional. Following anthesis in 1957, there was a rapid decrease in the proportion of functional egg cells. In advanced cases of degeneration the egg cell was identifiable only as a black streak in the micropylar extremity of the embryo sac.

At anthesis in 1958, only 64 per cent of the embryo sacs had reached the eight-nucleate stage. Only 12 per cent had formed an egg cell, all of which were apparently functional. Functional and degenerated egg cells were observed as in 1957, but two additional types that may or may not have been functional were noted in 1958.

Within two days of anthesis in 1958, 30.3 per cent of the embryo sacs were functional. In the subsequent collections of pistils the proportion of degenerate or probably degenerating egg cells increased. The proportion of functional or doubtful egg cells meanwhile decreased. As expected, both the proportion of embryo sacs which had not reached the eight-nucleate stage and the proportion of eight-nucleate embryo sacs in which egg cells had not been formed decreased steadily throughout the sampling period.

In hand-pollinated flowers of Windsor, pollination one day after anthesis was more effective than pollination two days after anthesis. This substantiates the conclusion that the proportion of functional embryo sacs decreased following anthesis.

Because of the decreasing proportion of functional embryo sacs following anthesis, and since pollination one day after anthesis was more effective than pollination two days after anthesis, it was concluded that one reason for the failure of fruit to set adequately under commercial conditions may have been that cross-pollination often occurred at too long an interval after anthesis. Fertilization was not detected in any of the Vista pistils although the pollen was compatible. It was considered that fertilization would not have occurred under the prevailing conditions in a period of three to five days after pollination.

The importance of providing an adequate means of cross-pollination immediately at anthesis is emphasized. Further work will be required to determine the true nature of the probably degenerating or doubtful egg cell types. A comparison of the percentage of functional embryo sacs with the percentage of fruit reaching maturity in the same year would give valuable information. More work is needed on temperature effects on megagametophyte development.

Microfilm $2.00; Xerox $4.40. 82 pages.

CORN GRAIN YIELDS AS RELATED TO NUTRIENT ELEMENT CONTENT OF LEAVES AND TO FOLIAR SPRAY TREATMENTS.

(L. C. Card No. Mic 59-2889)

J. Benton Jones, Jr., Ph.D.
The Pennsylvania State University, 1959

Corn leaf tissue was collected at four locations in Pennsylvania in order to determine the effect of high nitrogen fertilizer applications and increasing plant populations on the nutrient element content of the leaf tissue and their relationship to grain yield. The 5th and 6th leaf from the base of the corn plant was selected when the ears began to silk. The N, P, K, Ca, Mg, Mn, B, Cu and Zn content of the dried green tissue was determined using standard analytical procedures. The nutrient element content of the leaf tissue varied depending on location and corn hybrid, with the Cu, Zn and B content showing the widest range of variation. Increasing nitrogen fertilizer and plant populations had no significant effect on the nutrient element content of the leaf tissue. At the lower plant populations (12,000 to 16,000 plants per acre), no significant relationships were found between grain yield and the nutrient element content of the corn leaf tissue. At the higher plant populations (18,000 to 20,000 plants per acre), grain yields were significantly and negatively correlated with the K, Mn and B content of the leaf tissue. The degree of these relationships varied depending on location. Combining the four location results, grain yields were found to be significantly and negatively correlated to the K, Mg, Mn, B, Cu and Zn contents of the leaf tissue.

The number of significant correlations among the nutrient element contents varied depending on location and increased with increasing plant population. The large number of significant inter-relationships among the nutrient element contents of the leaf tissue, especially at the higher plant populations, indicated the possible importance of nutrient element balance and its influence on grain yields.

The effects of trace element containing sprays on corn grain yields were studied under field conditions in 1957 and 1958. In a preliminary investigation in 1957, a significant increase in the number of harvestable ears and ear weight was obtained among 16 single-crosses using a spray containing copper and boron. At one location, a copper spray resulted in a significant increase in yield on the high nitrogen fertilized plots. In 1958, trace element sprays containing the elements: Cu, Zn, Mo, Fe and B, were applied to corn plants in the field when the plants were 1 foot high and later when they were 3 feet high. A commercial spray, "Nutri-Leaf 60," was included in the spray program. Grain yield responses varied depending on hybrid, soil moisture conditions, level of nitrogen fertilization, and composition and time of spray application. Significant grain yield responses were obtained where soil moisture was inadequate during a portion of the growing season. When the soil moisture conditions were adequate during the entire season, no significant yield responses were obtained. The commercial spray gave consistently the best yield increase among the four-way crosses. A single spray application when the plants were 1 foot high gave a more consistent yield increase among several four-way crosses than the two-spray application method described previously. The most significant yield responses to the sprays were obtained among the single-crosses. The nature of the yield response varied depending on the level of nitrogen fertilization, hybrid and the boron content of the spray. The drought-susceptible hybrids gave consistently the best yield increases to all of the sprays indicating a possible relationship between the nutrient element content of the plant and its drought susceptibility.

The unusually high quantities of Mn and K found in the leaf tissue indicated a possible lack of a proper nutrient element balance which was resulting in low grain yields. This balance may be more critical during moisture deficient seasons and of greater importance with certain hybrids. A proper balance may be acquired by spraying plants with the necessary nutrient elements. The exact nature of this balance was not revealed in this investigation. Microfilm $2.00; Xerox $4.60. 89 pages.

AMMONIA VOLATILIZATION LOSSES FROM NITROGEN FERTILIZERS WHEN APPLIED TO SOILS.

(L. C. Card No. Mic 59-2893)

Conrad Buehler Kresge, Ph.D.
The Pennsylvania State University, 1959

During the last decade, the use of nitrogen fertilizers applied as side-dressings and top-dressings has increased many fold. In addition, rates of application are larger. The nitrogen in many of the newer fertilizers is either ammoniacal or becomes ammoniacal on hydrolysis. At high rates of application, an accumulation of ammonia is likely at the site of application until nitrification and diffusion occur. Under certain conditions ammonia volatilization losses could be appreciable. It was the purpose of these studies to determine if volatilization of ammonia from fertilizers applied to the soil occurred in amounts large enough to warrant concern. If significant losses were found, the purpose would extend to a study of conditions which influence volatilization of ammonia.

Most of the studies were conducted in closed systems. Soils with various properties were subjected to selected moisture, fertilizer, and plant cover treatments. The soils were placed in sealed containers. The containers used in the laboratory were two-quart glass screw-cap jars while those employed outside and in the greenhouse were two-gallon glazed crocks covered with transparent hoods. Air was passed over the soils and then bubbled through standard sulfuric acid which was titrated periodically. Neutralization of acid in excess of that obtained with air passed over untreated soil was assumed to be caused by ammonia volatilized from the fertilizers. At rates equivalent to 300 pounds of nitrogen per acre, surface applications to bare soil (pH 5.5 to 6.6) resulted in significant ammonia losses from urea and calcium cyanamide but not from ammonium nitrate or sulfate. Ammonia volatilization was significantly reduced when urea was allowed to diffuse into the soil for several days under moist storage or when urea was top-dressed to a growing crop.

A field experiment was conducted in which three nitrogen fertilizers were top-dressed to sudangrass. The

grass was planted in stove pipe sections (12 in. long and 8 in. in diameter) which had been imbedded in the soil. The pipes and contents were covered during heavy rains to eliminate leaching as a variable. Losses of ammonia by volatilization were evaluated by: (1) sudangrass yields and percent nitrogen and (2) soil analyses, including nitrate, ammonium, and total nitrogen. It was not possible to conclude, on the basis of the results from the field experiment, whether ammonia was volatilized from urea at rates up to 338 pounds of nitrogen per acre.

Results obtained indicate that: (1) top-dressing of urea to a growing crop at rates below 100 pounds of nitrogen per acre and at soil pH values below 6.3 can be made with little fear of ammonia volatilization; (2) if higher rates of urea are mixed with the soil or if urea top-dressed at these rates can diffuse into the soil before rapid drying occurs, losses of ammonia probably will not present a problem; and (3) if urea is not uniformly distributed on the soil surface, significant losses can take place at any practical rate of application because uneven spreading can cause local concentrations much greater than the intended rate.

Microfilm $2.00; Xerox $4.80. 93 pages.

HYDROLYTIC AND RESPIRATORY ENZYMES OF SPECIES OF DITYLENCHUS AND PRATYLENCHUS.

(L. C. Card No. Mic 59-2514)

Lorin Ronald Krusberg, Ph.D.
North Carolina State College, 1959

Supervisor: Joseph Neal Sasser

Homogenates and extracts of Ditylenchus triformis, D. dipsaci and Pratylenchus zeae were assayed for enzymes involved in hydrolysis, respiratory metabolism and terminal oxidation by techniques involving viscosity, titration, colorimetric and spectrophotometric measurements.

Cellulolytic (Cx) enzyme activity was present in homogenates of all three nematodes and pectinmethylesterase and amylase activities in homogenates of D. triformis and D. dipsaci. Variable proteolytic and no polygalacturonase activities were found in homogenates of these nematodes. Other enzymes detected in extracts of both the latter species of nematodes were hexokinase, phosphoglucomutase, phosphoglyceric mutase-enolase, glucose-6-phosphate dehydrogenase, 6-phosphogluconic dehydrogenase, condensing enzyme, isocitric dehydrogenase, malic dehydrogenase, "malic" enzyme, diaphorase, and DPNH-cytochrome c reductase. The hexokinase in extracts of D. triformis was active with glucose, fructose, galactose and mannose, in order of decreasing reactivity. Lactic dehydrogenase was present in extracts of D. triformis, but was not conclusively demonstrated in extracts of D. dipsaci. Fumarase and cytochrome oxidase were detected in extracts of D. triformis. Absorption spectra of reduced versus oxidized extracts of D. triformis had one absorption peak around 430 mμ (Soret bands) and another much broader peak around 550 mμ (cytochrome c). Spectroscopic observations with massed intact nematodes revealed a dark absorption band around 550 mμ and a fainter one around 605 mμ, indicating the presence of cytochromes c and a, respectively.

The overall metabolism of Ditylenchus species seems to follow the general pattern established for the metabolism of other animals, including animal parasitic nematodes. Microfilm $2.00; Xerox $5.00. 97 pages.

AGRONOMIC RESPONSES OF CANNING PEAS TO A NEW SEEDING IMPLEMENT.

(L. C. Card No. Mic 59-2772)

Gerald Alvin Marx, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Donald J. Hagedorn

A three year study was conducted to evaluate the effect of a new experimental (XP) pea drill on the yield and quality of canning peas. Its performance was compared with that of the now commonly used conventional (Conv.) grain drill. Two representative varieties of canning peas, Alaska and New Line Early Perfection (NLEP) were used. The influence of variable plant population was also investigated. Finally, an effort was made to determine the accuracy with which plot yield could be estimated from small sample data.

Among the features incorporated into the experimental drill were: (1) vertical wheel seed cups designed to discharge the seeds at precise intervals in the row; (2) depth bands on the furrow openers to place the seed at a uniform depth; (3) press wheels to firm the soil over the seed; and (4) a weeder attachment to improve the condition of the seedbed. The implement was also capable of separate fertilizer application, both below and to the side of the seed, but this attribute was not evaluated in this study.

In contrast to the Conv. drill, the XP drill proved very efficient in its capacity to distribute the seed at a uniform depth. Increased uniformity of seedling emergence, expected under uniform depth of seeding was not demonstrated, however. But there was a tendency for the plots sown with the XP drill to give a higher percentage of plants per pound of seed sown. With respect to its capacity to distribute the seed at uniform intervals within the row, the XP drill performed significantly better than the Conv. drill, but considerably less than ideal. Plots sown with the XP drill tended to flower and fruit no more uniformly than those sown with the Conv. drill. Variable plant population likewise appeared to exert little or no influence on uniformity of maturity as indicated by the composite tenderometer of ungraded peas and by the distribution of sieve size grades.

The most conspicuous effect of the XP drill was that of increased yield per acre. At identical initial seeding rates plots sown with the XP drill consistently produced higher yields than those sown with the Conv. drill. Even at plant populations below that provided by the Conv. drill, plots sown with the XP drill produced higher yields, but these differences were not always significant. This study failed to reveal the exact attribute or attributes of the XP drill responsible for these yield increases.

With but one exception the highest yields were obtained

when the theoretical distance between successive plants was 1 7/16 inches. However, for the NLEP variety the difference in yield over the intermediate rate (plants theoretically 2 1/8 inches apart) was not sufficient to warrant the additional cost of the seed. These results indicated that the NLEP variety was more adaptive to variation in plant population than was the Alaska variety, and that a decrease in the usual seeding rate may be justified.

On the individual plant basis decreased plant population caused a corresponding increase in the number of pods per plant and peas per pod. Weed growth was greatest under low plant populations and least under high plant populations.

There was some evidence to suggest that the lower per acre yields in the plots sown with the Conv. drill resulted from a failure of the individual plants in these plots to give a commensurate response to variable plant population. Although the yield per plant did fluctuate with differences in plant population, it did not increase or decrease at the same rate as the plants from the plots sown with the XP drill.

Total green weight of plant material, both peas and weeds, per unit area was remarkably similar for a given variety and year. Under low plant (pea) populations the decreased weight of peas was largely supplanted by an increased weight of weeds.

The single most influential factor responsible for wide year-to-year yield variation was the environment. This was apparent, moreover, with virtually every variable under observation.

Evidence was given to show that plot yield can be estimated with considerable accuracy from small sample data. The multiple regression technique was employed to illustrate that only two components, plant population and weight of peas per plant, need be used to predict plot yield. It was also shown that by holding yield per plant constant, plot yield became a direct function of plant population. Microfilm $2.00; Xerox $6.60. 137 pages.

THE EPIDEMIOLOGY OF THE JACK PINE-OAK GALL RUST IN WISCONSIN.

(L. C. Card No. Mic 59-2773)

James Edward Nighswander, Ph.D.
The University of Wisconsin, 1959

Supervisor: Assistant Professor R. F. Patton

The eastern gall rust, which is pathogenic to a number of species of pine and oak in eastern United States and Canada, has, in some years, limited the culture of jack pine in both nurseries and forest stands in certain areas of Wisconsin. The amount of new infection occurring on pine fluctuated greatly in different years and in different localities. This indicated a need for clarification of the conditions necessary for "wave-infection years."

The biology of the causal fungus was studied to determine conditions necessary for spore production, spore germination, and oak and pine infection, and this information was related to the epidemiology of the disease in the field. Aeciospores were produced in early May after about 1 week of day time temperatures above 20°C. They germinated over a range of constant temperatures from 8° to 28°C with an optimum of 20°C. Urediospores were produced on young oak leaves 6 to 11 days after infection at a series of constant temperatures from 16° to 24°C. Uredia continued to produce viable spores for almost 2 weeks. Spores germinated within a range of constant temperatures from 4° to 28°C with an optimum of 20°C. Teliospores were produced on oak leaves at constant temperatures from 16° to 28°C. They remained viable for up to 46 days and germinated at temperatures from 12° to 24°C in the presence of free water. At 20°C the telia cast basidiospores after 9 hours. Basidiospores formed germ tubes on pine decoction agar, but only secondary sporidia on other substrates. Normal germ tubes formed at temperatures from 12° to 24°C after a minimum of 4 hours after the spores were cast.

Seasonal development studies revealed that a series of favorable events was necessary for an inoculum "build-up" to occur on oak. Initial infection by aeciospores was conditioned by at least 10 hours of saturated air, accompanied by free water with the temperature between 8° and 28°C. Late spring frosts and dry weather during aeciopore dissemination limited the spread. Secondary spread by urediospores was limited by dry weather and the decreasing susceptibility of oak leaves with age. The susceptible foliage produced by sprouts from recently cut oak stumps tended to prolong uredial spread.

Infection of pine was only possible when viable teliospores were present on oak. In central Wisconsin they were usually present from the first week in June until the first of July if secondary spread by urediospores did not occur or for about 2 weeks longer if secondary spread did take place. A period of 13 hours of 100 percent humidity following a measurable rainfall was necessary for production and germination of basisiospores. These conditions occurred infrequently and in some years not at all in central Wisconsin.

Several fungicidal materials were tested for their effectiveness in controlling the rust on seedlings in the nursery. Zineb and ferbam applied at the rate of 2 lb/acre gave the best control.

Microfilm $2.00; Xerox $5.20. 102 pages.

EFFECT OF pH ON THE UPTAKE OF NATIVE AND APPLIED NITROGEN, PHOSPHORUS, AND POTASSIUM.

(L. C. Card No. Mic 59-2781)

Salai Tun Than, Ph.D.
The University of Wisconsin, 1959

Supervisor: Assistant Professor A. E. Peterson

The effect of soil pH on the availability of native and applied nitrogen, phosphorus, and potassium was investigated. An acid Gray-Brown-Podzolic soil from north central Wisconsin was used for three continuous croppings of Sudan grass in the greenhouse. After each harvest, determinations were made for the pH, ammonium-and-nitrate nitrogen, available phosphorus, and exchangeable potassium in the soil, and the total nitrogen, phosphorus, and potassium in the plant tissue. Statistical

analyses were made on the uptake of nitrogen, phosphorus, and potassium for the entire three crops. The effect of soil pH on the formation of water-stable soil aggregates were determined after harvest of third crop.

The soil pH dropped sharply during the growth of the first crop and increased slightly by the time the third crop was harvested. The lowest pH values were obtained for the ammonium nitrate treatments. Only a slight drop in soil pH was observed for the manure treatments.

There was a significant increase in uptake of nitrogen due to the application of lime to the unfertilized, and nitrogen and phosphorus fertilized soils.

The nitrogen uptake was significantly greater when nitrogen was applied with phosphorus than with potassium. Liming did not significantly influence the uptake of nitrogen for the manure treatments.

A significant increase in uptake of phosphorus as a result of liming was obtained in all the manure treatments and in the no-fertilizer treatment for more than 2000 ppm. of lime. There was a trend of increasing uptake of total phosphorus with increasing soil pH for the treatment including phosphorus, potassium, and manure. The phosphorus uptake was significantly greater for addition of phosphorus with potassium than with nitrogen.

Supplying additional potassium with the manure resulted in a significant increase in the uptake of total potassium. In the nitrogen, phosphorus, and potassium treatment lime applications significantly increased the uptake of total potassium. A significant negative response was obtained in potassium uptake from the application of lime in the treatments which included nitrogen and phosphorus, and phosphorus and potassium.

The application of fertilizers increased the average uptake of native soil nitrogen by 40 percent, native potassium by 195 percent, but decreased uptake of native phosphorus by 10 percent. The application of lime increased the average uptake of native nitrogen by 15 percent, of native phosphorus by 20 percent, but gave no increase in uptake of native potassium.

The application of fertilizers increased the uptake of applied nitrogen by 30 percent, applied phosphorus by 7 percent, and applied potassium by 45 percent. Also, the application of lime increased the average uptake of applied nitrogen by 10 percent, applied potassium by 5 percent, but gave no increase for applied phosphorus.

The percentage of water-stable soil aggregates larger than 1.00 mm. were higher for all treatments of lime, fertilizers, and manure. Manure, however, increased soil aggregation more than either lime or fertilizer. Phosphorus and potassium applied in addition to the manure had little or no effect on soil aggregation.

Microfilm $2.00; Xerox $4.00. 72 pages.

POTASSIUM AVAILABILITY IN SURFACE AND SUBSOIL HORIZONS AS MEASURED BY PLANT UPTAKE AND CHEMICAL EXTRACTION.

(L. C. Card No. Mic 59-2783)

Carol Glenn Wells, Ph.D.
The University of Wisconsin, 1959

Supervisor: Assistant Professor R. B. Corey

Laboratory, greenhouse and field experiments were conducted to determine the amount of potassium released to the exchangeable form by drying the soil and the effect of this release on soil test correlations and plant uptake, to determine the amount of potassium fixed by various soils and to measure the availability of the fixed potassium, and to evaluate the relative importance of exchangeable potassium at various soil depths to plant nutrition.

The amount of exchangeable potassium in the nondried subsoils was low compared to that in surface soils, and, in general, the amount decreased with depth. Drying the soils released from 0 to 250 pp2m. of potassium to the exchangeable form, and the amount released increased with depth.

Potassium released by drying was available to plants, and the amount released by drying as shown by cropping with ryegrass was greater than the amount released as determined by ammonium acetate extraction.

Exchangeable potassium values as determined in either moist or dried soil samples from the plow layer were equally reliable as indices of available potassium in soils which showed only slight changes in exchangeable potassium on drying. However, exchangeable potassium determined in moist soil samples was the more reliable index of available potassium for soils which showed relatively great changes in exchangeable potassium on drying. Exchangeable potassium in either moist or dried samples was not a suitable measure of available potassium in soils which contained significant amounts of fixed potassium.

In the laboratory experiment with soils from various horizons of the Fayette and Tama silt loams, the subsoils fixed considerably more potassium against ammonium acetate extraction than did the surface soils, and the Fayette subsoils fixed more potassium than did the Tama subsoils. Fixed potassium in these soils, although released more slowly than exchangeable potassium, was available to plants.

The amounts of potassium extracted from soils in a single extraction with one normal acetate salts varied with the cation. The order of effectiveness of the following cations in extracting potassium from soils from the Fayette Ap and B_2 horizons was NH_4>Na>Ca>Mg, which is the inverse order of their hydrated diameters. This indicates that potassium may be fixed against extraction with the more highly hydrated ions without complete contraction of the 2:1 layer silicates.

Estimations based on root activity of corn (determined by uptake of injected radioactive phosphorus) and exchangeable potassium in the moist samples from the various horizons of the Fayette and Tama silt loams indicated that these subsoils contribute very little potassium to the corn crop.

In field studies, simple, partial and multiple correlations of exchangeable potassium at various soil depths with percent potassium in the alfalfa, potassium uptake by the alfalfa and yield of alfalfa indicated that exchangeable potassium in the plow layer was the most important factor in predicting percent potassium in the alfalfa, but there were indications that potassium in subsoils contributed appreciably to the potassium nutrition of alfalfa. In a year when moisture was lacking in the early part of the growing season, there was a closer association of exchangeable potassium in the subsoils with yield of alfalfa than with percent potassium in the alfalfa. This indicates that potassium in the subsoil may greatly influence yield when the potassium availability in the plow layer is low.

The results of this study indicate that soil tests for potassium could be more logically interpreted if the soils were characterized with regard to release of potassium on drying, content of fixed potassium in the surface soil and the available potassium level in the subsoil.

Microfilm $2.00; Xerox $6.80. 143 pages.

ANTHROPOLOGY

THE STRATIGRAPHY OF INTIHUASI CAVE, ARGENTINA AND ITS RELATIONSHIPS TO EARLY LITHIC CULTURES OF SOUTH AMERICA

(L. C. Card No. Mic 59-2582)

Alberto Rex Gonzalez, Ph.D.
Columbia University, 1959

In San Luis Province of Argentina, in the region known as the Sierras Centrales, there is a large cave called Intihuasi. Careful scientific excavation of the refuse was conducted by the author in 1951. The Department of Highways had previously dug into the deepest deposits, dumping the materials to one side. This report deals with a description of the excavations, the artifacts recovered, and the criteria for the establishment of four distinct levels of human occupation. The geological correlation of the various layers in Intihuasi Cave, with other geological sequence of the Sierras Centrales and Pampas of Argentina, prove that the oldest culture in this site was established in the Sierras Centrales in a period almost contemporary with the Atlantic Period of the European post-glacial sequence. Carbon 14 material from the lowest horizon (Intihuasi IV) confirm this correlation with a date of 7,970 ± 100 years.

Each of the four horizons is typified by a series of artifacts that are described in detail. The most important is the lowest level, known as Intihuasi IV, which has lanceolate projectile points. These points are the same type as Ayampitin from another early occupation in Argentina and hence this horizon has been called Ayampitin Culture. The transitional layers have distinctive traits but also show a blending or mixture of features. The introduction of triangular points on top of the lanceolate point culture proves that another cultural tradition entered the region.

The Intihuasi Cave stratigraphy proves without any doubt the existence of early hunting and gathering cultures in southern South America almost 8,000 years ago.

Microfilm $2.70; Xerox $9.40. 206 pages.

MORNE PAYSAN: PEASANT COMMUNITY IN MARTINIQUE. AN APPROACH TO A TYPOLOGY OF RURAL COMMUNITY FORMS IN THE CARIBBEAN.

(L. C. Card No. Mic 59-2850)

Michael M. Horowitz, Ph.D.
Columbia University, 1959

The study is in three sections: a description of a highland peasant community in Martinique in terms of structural analysis; a comparison of this community with seven others in the West Indies; and a typological classification of rural West Indian communities.

A community is the smallest social system which provides for the transmission of a culture and allows for the emergence of new cultural forms which will themselves be sustained and transmitted. Most anthropologists agree that such systems are among the universals of human social experience. In analyses of the Caribbean, however, there is seldom a discussion of the kind of community in which a problem was studied. The hypothesis here tested is that there is a range of community types in the rural Caribbean, some being highly integrated and associated with a peasant economy, some open and associated with a plantation economy.

The Martiniquan village of Morne-Paysan, which the author studied during 18 months, is a tightly integrated community, one in which the great majority of significant interaction of its members occurs within its bounds. Located in the highlands of the island, settled by freed men who refused to remain on the estates, it maintains a peasant horticultural economy, with almost total independence from the coastal plantations. The people own or rent small plots of land, worked by household members and by cooperative labor exchange groups. Produce beyond the needs of the household is sold for cash in urban markets. The community has a stable population, predominately endogamous, with a high rate of durable household groupings.

About 1650 persons live in the community, 250 of whom reside in the bourg, a central administrative section. The rest are dispersed in scattered neighborhoods or quartiers, with considerable distance among homesteads, each household building a home on its own clearly delimited piece of land. This settlement pattern is characteristic of Brittany

and Normandy, from whence came the plurality of the original European colonists in the 17th century.

To a high degree Morne-Paysan is a kin settlement, since its dominant endogamy and lack of unexploited land with no alternative sources of income discourage outsiders from settling there. In other West Indian communities recruitment to membership is often much freer and there is more turnover in population. In terms of a structural model Morne-Paysan is compared with two communities in Puerto Rico, two in British Guiana, and three in Jamaica, to demonstrate the range of forms known to the area.

The comparative terms of the model include the indices of personnel, space, time, function, and structure. In those communities characterized by a peasant economy structural relations are tightly integrated. The exploiting unit is the corporate household, with well-defined allocation of task by sex and age. Labor is not a commodity, and reciprocity among households is the rule. Esprit de corps is marked and the members view their community as distinct from all others. The people do not migrate in search of wage labor on the estates. In those communities in which wage labor in the sugar fields provides the source of income there is a continual change in membership, as others come in during crop time. Households are not corporate, and tend to be less durable, as there is little division of labor among the sexes. These communities are sharply stratified along economic lines. In several communities in which both estate labor and peasant proprietorship are present the degree of integration achieved is somewhat intermediary. Microfilm $2.85; Xerox $9.80. 219 pages.

A STUDY OF THE IMPACT OF MODERN LIFE ON A CANADIAN INDIAN BAND

(L. C. Card No. Mic 59-2858)

Claudia Louise Lewis, Ph.D.
Columbia University, 1959

The task of this research project was to make a case study of an Indian community, with the larger aim of demonstrating a method of approach which might be applied in comparable situations. The study is in line with others in which the insights of the social sciences are brought to bear upon problems of community development. A Vancouver Island Salish Indian reserve presented a challenging situation. The eight hundred Indians of the "Camas" Reserve, as I have called it, though they live on the doorstep of a prosperous small town, retain their old winter dance ceremonies, itinerant habits, and marriage customs; alcoholism is a serious problem; their villages constitute an outlying slum of the town.

My theoretical premise rested upon the assumption that functional relationships make an intelligible whole of the kinship structure, economic life, social organization, and symbolic systems of any group; that the resulting pattern constitutes an apparatus for the satisfaction of needs; that such needs find their locus in the network of interpersonal relationships. My aim was to study the Camas Band in terms of these functions and relationships. Residence during the summers of 1954 and 1957 on the edge of the reserve provided opportunities for participant observation and "event analysis." Approximately fifty Indians were interviewed informally, as well as fifteen White residents of the town, and officials of the Indian Agency.

Study of anthropological materials was undertaken to acquaint myself with the early culture. In pre-contact times the Camas Indian lived in a well integrated society in which climate and topography made possible a rich economic life, bolstered by religious belief, kinship structure, and status-achieving mechanisms. With the coming of the White man in the 1860's, the Indian became a ward of the Government. By 1954, though he had achieved some equal rights, he remained a dependent in many respects, and in the town there was some discrimination against him.

Study of the present-day settlement pattern, household life, stability of marriage, and roles of family members revealed that old systems of interaction prevail and give coherence to Camas life, despite some outer appearances to the contrary. The camp-like Indian house, offensive to the White neighbor, is functional in that it frees its owners to travel in the old accustomed seasonal round, and to make frequent visits to kin; in its lack of housekeeping it reflects an old system of relationships in which care of the house was the grandmother's obligation, not the young wife's. The wife today goes off with her husband to the beer parlor if he wants her to, in an old pattern of social interaction.

It is my conclusion that the old ways have endured partially because alternatives offering comparable satisfactions have not been available. In the winter dances, in some of the drinking patterns, and in the Indian Shaker Church--a new development incorporating old customs--old avenues to status are open.

It is my recommendation that new measures be taken to move the Indian closer to equality with the White man and to encourage his independence, in order that he may find it possible to achieve status in the White community's terms as satisfactorily as he now achieves it through perpetuation of his old ways. I have predicted that some of the habits of association established long ago may persist indefinitely. The task of the administrator is not only to encourage Indian leadership and decision-making at every step of the way, but to be receptive to new developments in community living which may be uniquely Indian in their origin.

Microfilm $3.80; Xerox $12.80. 295 pages.

BAND ORGANIZATION OF THE PEEL RIVER KUTCHIN

(L. C. Card No. Mic 59-2597)

Richard Slobodin, Ph.D.
Columbia University, 1959

This is a study of extrafamilial primary groups in a society of hunters, based primarily upon two sojourns, 1938-39 and 1946-47, among the Kutchin. It is concerned with structure and function of groups and with changes in these as conditioned both by ecological variation and by historical development.

The Kutchin are Northern Athapaskan-speaking Indians of eastern Alaska and the western Canadian Arctic and subarctic. The Peel River people, one of half a dozen

autonomous Kutchin bands, occupy the drainage of the Peel, a tributary of the Mackenzie River. They subsist largely by hunting, fishing, and trapping.

A good deal can be ascertained of Peel River social history since shortly prior to initial EuroAmerican contact. For purposes of study, this history may be seen as comprising the following periods: 1. Protocontact: late eighteenth and early nineteenth centuries; 2. The "Old Days": post-contact nineteenth century, 1840-98; 3. Klondike Gold Rush, 1898-1917; 4. Muskrat or Recent, 1917-1947.

With a brief outline of Peel River social organization as background, the extrafamilial groupings are described. Throughout known Peel River social history, the following types of grouping can be discerned.

1. Trapping party

   4-8 families
   Mobile
   Duration: part or all of winter season
   Formal structure: tendency toward bilateral extended family
   Leader: Mature hunter of high prestige in subsistence activities
   Activities: trapping marten and fox; meat hunting.

2. Local Group

   4-8 families
   Localized
   Duration: one or two generations
   Formal structure: bilateral extended family, with slight emphasis on female lineage because of initial matrilocality.
   Leader: Senior kin of highest prestige within the kin-group
   Activities: Trapping; hunting; collective hospitality; some collective trading.

3. Meat Camp

   15-50 families
   Localized
   Duration: Part or all of winter season
   Formal structure: Differentiation by: matrilineal sib (obsolete); wealth-rank (now slight); age-group.
   Leader: Older-mature or elderly man of high rank; ceremonial leader
   Activities: Caribou hunting; ceremonial.

4. Fish Camp

   10-30 families
   Localized
   Duration: All or part of summer season; may be reactivated each summer for many years
   Formal structure: as in 3
   Leader: as in 3; associated by residence with fishing site
   Activities: Fishing; ceremonial; games.

5. Trading Party (obsolete)

   Relatively large; range of size not ascertainable
   Mobile within narrow limits
   Duration: Part of Winter or early summer season
   Formal structure: as in 3
   Leader: as in 3
   Activities: Trading; ceremonial; games.

6. Band Assembly

   50-70 families
   Localized
   Duration: brief, except in emergency
   Formal structure: as in 3; at present, sex division more marked than age-grouping
   Leader: The "chief"; i.e., trade and ceremonial leader of high status. No age limitation on leadership, past early adulthood.
   Activities: Ceremonial; games; trading (obsolete).

Two types of groups are not discussed. They are the obsolete war party and the men's hunting party. Both are all-male, special-purpose associations of brief duration. Both are characteristically instruments of large groups, i.e., meat camp, trading party, or band assembly.

Description is given of the specific situations in which each type of grouping has been formed. Ecologic factors may be seen to give prominence now to one type of grouping, now to another. The effects of historic change have been diverse, rather than tending toward the predominance of any one type of grouping.

Peel River Kutchin social forms have varied within relatively narrow limits. Principles of social action have shown striking persistence. Adaptive variation is also evident; the social order has shown viability and vitality in face of the range of situation which have thus far confronted the Peel River people.

Microfilm $2.35; Xerox $8.20. 178 pages.

THE BARADOSTIAN INDUSTRY AND THE UPPER PALAEOLITHIC IN THE NEAR EAST

(L. C. Card No. Mic 58-7053)

Ralph S. Solecki, Ph.D.
Columbia University, 1958

The Baradostian industry is a unique Upper Palaeolithic blade and burin industry recovered by the author in one of four major cultural layers of Shanidar Cave, in the Zagros Mountains of Kurdistan Iraq. Closely related to the Aurignacian proper of Europe, the Baradostian industry was found to be the earliest representative of the Aurignacian tradition in the Near East. The Baradostian industry resembles closest the Upper Palaeolithic Phase III of the six part sequence as set up by Neuville for the Near East.

The Shanidar Cave cultural layers from top to bottom include a Recent to Neolithic layer, a very late Upper Palaeolithic or Mesolithic layer, the Upper Palaeolithic Baradost layer, and the Middle Palaeolithic Mousterian layer. An interdisciplinary approach using geological, biological and climatological data was used in the archaeological investigation.

The base of the Baradostian layer was dated by the carbon 14 method to be over 34,000 years old, and the upper part was dated 29,500 years before the present.

There is a cultural disconformity between the Mousterian (Hazer Merd) layer and the Baradostian layer. A hiatus of at least 14,000 years duration is present between the Baradostian layer and the succeeding very late Upper Palaeolithic or Mesolithic (Zarzi) layer.

Nearly one third of the implements of the Baradostian industry are well made burins, which give it a distinctive character. Scrapers are the most common implement type, accounting for thirty six percent of the total frequency. Core scrapers are dominant within the scraper type. Points, including Font-Yves and Mousterian types, and notched blades and flakes occur next in frequency. Through the use of geochronological evidence and "index fossil" types, the relationship of the Baradostian with the sequence at Ksâr 'Akil, the Lebanon, has been established. The chronological place of the Baradostian is the earliest of the Aurignacian in the Near East. The thesis that this tradition entered Southwest Asia from Eurasia via the Transcaucasus is substantiated. This penetration appears to have occurred just following the Würm II glaciation, with the return of a warmer climate. The Baradostian flourished at Shanidar into the beginning of the third stadial of the last glacial period, or Würm III of the Alpine sequence. This, one of the coldest periods of the Pleistocene, is dated from about 25,000 to 11,000 years ago. With the rendering of the climate in the Zagros Mountains uninhabitable, the Baradostians were forced to leave. The eastern Mediterranean area, with a less rigorous climate, appears to have favored a longer cultural history during the Upper Palaeolithic. However, there too a gap is evident in the archaeological sequence of a number of sites, indicating a break in the habitation of widespread proportions. The Würm III period appears to have been also responsible for a depopulation in Soviet Asia and other parts of the Near East during the late Upper Palaeolithic. With the close of this last glaciation, and the return of a more ameliorative climate, life began to flow back into the abandoned areas, with the incursion of peoples basing their economy upon new technologies. These were the very late Upper Palaeolithic (Phase VI in the Near East) or Mesolithic cultures.

Microfilm $2.40; Xerox $8.40. 181 pages.

ASTRONOMY

EXCITATION TEMPERATURES AND TURBULENT VELOCITIES IN SUNSPOTS

(L. C. Card No. Mic 59-2962)

Robert Howard, Ph.D.
Princeton University, 1957

High dispersion spectra of several small and medium sized sunspots were obtained with the 16-inch coronograph of the Sacramento Peak Observatory. Equivalent widths and half widths were measured. A curve of growth was constructed for each spot. Excitation temperatures for iron derived from the curve of growth analysis averaged 4100°, assuming an excitation temperature of 4900° for the photosphere. There is evidence for a higher excitation temperature for smaller spots. Turbulent velocities derived from the curves of growth averaged 2.9 km/sec compared to 1.7 km/sec for the photosphere, while a line profile analysis gave an average of 3.7 km/sec compared with 1.5 km/sec for the photosphere.

Microfilm $2.00; Xerox $3.00. 27 pages.

BACTERIOLOGY

THE PHYSIOLOGY AND CHEMOAUTOTROPHIC METABOLISM OF NITROBACTER AGILIS

(L. C. Card No. Mic 59-2945)

M. I. Hussain Aleem, Ph.D.
Cornell University, 1959

Members of the genus Nitrobacter offer a unique problem to the microbiologist because of their obligate chemoautotrophic metabolism. These organisms are responsible for the conversion of nitrite to nitrate in soil and water and are especially important in agriculture since their metabolic activities supply growing plants with all the nitrate they need for growth. In spite of the importance of this microbial group in natural environments, its metabolism has been largely overlooked. The study deals with the nutritional requirements of these chemoautotrophs, the physiological factors governing their growth and the biochemistry of the process of nitrite oxidation brought about by these bacteria.

Nitrobacter agilis derives its sole energy for cell synthesis from the oxidation of nitrite to nitrate. An initial concentration of a low substrate level (ca 50 ppm NO_2-N) has been found necessary for the best initiation of growth. The exponantial phase of growth starts after ca 100 ppm NO_2-N are oxidized. Once the chemoautotroph is growing logarithmically, further additions of about 400 to 1000 ppm NO_2 - N can be made daily without depressing the growth rate. The organism is thus able to oxidize more than 3000 ug NO_2-N/ml when grown in 500 ml culture flasks with

200 ml medium and ca 7000 to 8000 ppm NO_2-N can be oxidized when grown in biomasses e.g. in ca 10 liters of the culture medium. The bacterium requires 5 ppm of each phosphorous, calcium and magnesium for maximum nitrification. A concentration of 0.007 ppm Fe has been found essential for the growth of the organism and 0.001 ppm for each molybdenum and zinc stimulate and increase nitrite oxidation whereas copper and manganese are slightly inhibitory. Various B vitamins and amino acids are without effect on the bacterium.

Sufficient cell yields have been obtained in relatively much less time by improving the culture medium following an investigation of the nutritional requirements in order to study the physiology and biochemistry of N. agilis. An effective aeration of 0.03 to 0.3 mmol oxygen/liter/min provides adequate aeration for growth. The rate of increase in microbial numbers is parallel to the nitrite oxidation. The pH optimum of the organism has been observed at 8.0, although there is a considerable oxygen consumption at as low a pH as 5.5 and as high as 9.8. Nitrate, the end product of nitrification, does not interfere with the process and concentrations of 5000 ppm NO_3-N, which are much higher than those actually found in natural environments, are not inhibitory to actively growing cultures. Similarly much higher concentrations of nitrite (ca 1000 ppm NO_2-N) do not depress the chemoautotrophic metabolism of the actively proliferating cells. The organism, however, is markedly sensitive to ammonium the natural substrate of nitrification. The toxicity increases with the increasing pH levels and ammonium concentrations. The increase in toxicity with greater alkalinity suggests that the active substance is free ammonia.

The cell free extracts of nitrobacter catalyze a rapid conversion of nitrite to nitrate stoichiometrically. The nitrite oxidizing enzyme complex possesses a high Michaelis constant and is insensitive to 250 umol nitrite/Warburg vessel. Optimum conditions for the oxidation require the presence of iron and a pH of 7.5-8.0. All the enzymatic activity resides in the particulate constituents of the cell. The marked inhibition by cyanide and stimulation by iron indicates a similarity between nitrite oxidizing enzyme and cytochrome oxidase in these chemoautotrophs.

It may be of interest to mention that cell free nitrification by nitrobacter has been studied for the first time by the author only. Microfilm $2.00; Xerox $6.60. 139 pages.

THE NUTRITIVE COMPOSITION OF A THERMOPHILIC VARIETY OF BACILLUS BREVIS

(L. C. Card No. Mic 59-2662)

Thomas Casimir Demny, Ph.D.
Syracuse University, 1959

The purpose of this investigation was to evaluate the nutritive composition of the thermophilic bacterium Bacillus brevis N.R.S. 1434.

Preliminary studies were concerned with the development of an "optimal" synthetic mass culture medium and determination of the favorable conditions for growth of this organism. Basic studies for ascertaining optimum pH and buffer concentration, lag reductant and stimulatory capacity of acetate, and the triangle method of varying three nutrients simultaneously ere conducted in shaken flasks at 55°C. The growth promoting effects of metals, vitamins, purines, pyrimidines, amino acids and several miscellaneous compounds when added to the triangle method developed medium were likewise studied in shaken flasks. Determination of optimal aeration-agitation levels for the propagation of the thermophile were made in 4-L fermentors.

The data obtained from the basic nutrition studies with the organism were translated to the larger fermentor for mass cultivation of cells and whole cultures so that analyses for protein, amino acid, fat, fiber, carbohydrate and vitamin contents could be made. Whole cultures were also added to chick diets to determine their growth promoting and/or toxic effects. Additionally, the basic data were used to attempt growth of the thermophile in several waste products.

Incidental to the main objectives of this study was an investigation with some of the compounds which would reverse amino acid inhibition of growth of the bacterium being evaluated.

The optimal initial pH for obtaining greatest cell yield of the thermophile, in the shortest time, was approximately 6.9. Increased phosphate buffer and sodium acetate concentrations were ineffective in maintaining the desired 6.9 pH, but the acetate addition to the basal medium did reduce lag time by 2 to 4 hr. In the triangle studies, monosodium glutamate, ammonium phosphate and glucose ratios exerted the greatest effect on growth. The probable reason that increased metal concentrations did not produce further stimulatory effects in the triangle studies were their high initial levels in the basal medium. Various B-vitamins, purines, pyrimidines, amino acids and miscellaneous compounds when added, singly and in combinations, to the triangle method developed medium did not increase total cell yield. With the synthetic medium developed, an oxygen absorption rate of 26.25 mM/hr/liter appears to approach optimum for the thermophile.

The chemical composition of cells and whole cultures of the thermophile grown in the synthetic medium developed was determined to be as follows: protein (Nx6.25), 60.06 and 45.43; crude fat, 4.84 and 2.73; crude fiber 1.81 and 0.31; ash 4.76 and 39.66; and carbohydrates (by difference), 28.53 and 11.87 per cent (dry weight) respectively. Determination of the vitamin content of the cells and whole cultures of the thermophile showed (as micrograms per gram): riboflavin, 207 and 33; thiamin, 49 and 5; niacin, 144 and 113; pantothenic acid, 234 and 63; biotin, 1.3 and 0.13; pyridoxine, 57.5 and 13.1; folic acid, 106 and 2.5; and B_{12}, 28.4 and 1.3 respectively. The cells and whole cultures were also shown by paper chromatography to contain the twenty amino acids most common to plants and animals.

Animal feed studies with whole cultures of the thermophile added to a complete chick ration, at a level as low as 0.15 per cent, stimulated a 6.3 per cent weight increase above that obtained with controls.

Other advantages of using thermophilic bacteria as animal feed supplements include rapid production rates, savings from cooling water costs and possible lessening of the dangers of microbial and phase contamination.

Microfilm $2.00; Xerox $5.20. 104 pages.

PRODUCTION OF A MANNOSE POLYSACCHARIDE BY PSEUDOMONAS FLUORESCENS FROM LOW MOLECULAR WEIGHT CARBON SOURCES

(L. C. Card No. Mic 59-2560)

Robert Garfield Eagon, Ph.D.
The Ohio State University, 1954

INTRODUCTION

The chance observation was made that Pseudomonas fluorescens OSU 64 produces rather large amounts of an extremely viscous material when grown in a simple medium composed of salts, 0.3 per cent yeast extract, and a low molecular weight compound, such as sodium acetate, as the source of carbon and energy. The properties of this viscous material suggested that it might be a polysaccharide. A search through the pertinant literature revealed practically no information regarding the polysaccharide-producing ability of this organism.

An additional factor which made the study of this problem even more attractive was the uniqueness which was suggested for the mechanism involved in the formation of a polysaccharide from a substrate such as acetate. The opinion usually expressed is that complex saccharides are never formed in significant amounts directly from unsubstituted monosaccharides since energy is required in the formation of a glycosidic bond. It has generally been believed that this must be supplied either in the form of a pre-existing glycosidic bond or as a C-O-P linkage such as is present in glucose-1-phosphate. Thus the formation of polysaccharide under the conditions described above appeared not to meet these general requirements.

The present paper is the result of studies made on the factors controlling the production of polysaccharide, on the polysaccharide per se, and on the metabolic mechanisms involved in the formation of this material.

RESULTS AND DISCUSSION

It was found that P. fluorescens would form polysaccharide from a variety of low molecular weight carbon sources, such as acetate, pyruvate, citrate, succinate, fumarate, malate, malonate, formate, and glycerol. Polysaccharide was not produced in significant amounts, however, when such substances as hexoses, pentoses, sucrose, or dextran were used as substrates. It was also found that growth and polysaccharide would result in concentrations of acetate up to 2 per cent and that good growth always preceeded polysaccharide production, indicating that polysaccharide was formed late in the growth cycle. When solid agar medium was prepared using these low molecular weight compounds as the carbon sources, polysaccharide was still produced and the colonies were surrounded by a heavy, clear area.

It was found that the pH of the medium had to be adjusted to 8.5-9.0 in order to have polysaccharide produced from glycerol. Polysaccharide was also formed from this compound when the concentration of the yeast extract was increased. Polysaccharide was formed, but to a lesser extent, from mannose and glucose when conditions were made alkaline. Large amounts of polysaccharide would form from these hexoses, however, if the medium were made alkaline and 1 per cent KCl, other potassium salts, or NaCl were added. This seems to indicate that polysaccharide production is dependent upon pH and potassium or sodium ions.

Because of the extremely high viscosity of the medium and since the polysaccharide was in immediate association with the organisms, it was not possible to remove the cells directly by centrifuging. It was found, however, that 10-15 seconds agitation in a Waring blendor sufficiently homogenized the medium so that the organisms could now be removed by centrifuging.

The polysaccharide was precipitated from this cell-free medium with equal volumes of ethanol. The precipitate, which formed in long, white, fibrous strands, was washed with ethanol several times and dried in a vacuum desiccator over $CaCl_2$.

A yield of approximately 10 per cent was observed, based on the amount of acetate added to the medium.

The presence of small amounts of protein in the crude precipitate was detected by a very weakly positive biuret test, a doubtful ninhydrin test, and by charring. The protein could be largely removed by boiling the polysaccharide from 3 to 5 minutes in 1 per cent NaOH and reprecipitating with ethanol.

As might be expected, this material gave a positive Molisch test for carbohydrates and negative Fehling's and Benedict's tests for reducing sugars.

A solution of the carbohydrate appeared to be neutral, indicating the absence of acidic or basic groups.

As is true for other high molecular weight polymers, a very low degree of solubility was observed, and a solution of this polysaccharide, even though very dilute, demonstrated a very high degree of viscosity, having an intrinsic viscosity of 8.45.

Evidence was obtained that this polysaccharide contained numerous long branches. This was shown by casting a thin sheet of an aqueous solution on a glass plate and observing that a brittle film resulted. Linear structures form pliable films; the degree of polymerization must exceed approximately 50 in order for a film to be produced.

Hydrolysis of the polysaccharide was brought about by heating in 0.1 N HCl for a period of 20 hours in a reflux condenser. After hydrolysis, the solution was freed of ions by the passage through a column of Amberlite MB-3, cationic exchanger, and Amberlite IRA-410, anionic exchanger. The resulting solution was as clear and colorless as distilled water.

The following chemical tests were now carried out upon the purified hydrolyzate:

1) The Molisch test for carbohydrates remained positive.
2) Benedict's and Fehling's tests for reducing sugars were positive.
3) Saliwanoff's test for keto-sugar was negative.
4) Tollen's phloroglucinol test for pentoses was negative.
5) Dische's carbazol reaction for hexuronic acids was negative.

Paper strip chromatography was employed next in order to identify the hydrolyzate. When a butanol-ethanol-water solvent and either p-anisidine hydrochloride or alkaline 3,5-dinitrosalicylate color reagents were used, the spot formed from the hydrolyzate corresponded very nicely to that formed from mannose. This finding remained

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constant when phenol was used as the solvent and the theoretical R_f value for mannose was obtained.

Sugar was removed from the hydrolyzate solution by evaporating to a thick syrup at low temperature under reduced pressure. Absolute ethanol was added to this syrup and a dry material resulted when ethanol was removed by evaporation.

A phenylosazone was prepared from this hydrolyzate which gave a melting point characteristic for mannose (204-5°C). A solution of this material demonstrated an optical rotation characteristic for mannose.

The hydrolyzate was fermented by yeast at about the same rate as mannose.

Since mannose oxidation is dependent upon adaptive enzymes and significant oxidation of mannose does not occur when the cells have been grown on another substrate, adaptive enzyme studies were undertaken in order to give more evidence that our sugar was indeed mannose. Cells that had been grown on mannose, hydrolyzate, or polysaccharide were adapted to both mannose and hydrolyzate, while those cells that were grown on glucose, ribose, or arabinose failed to demonstrate this adaptation.

In view of the difficulty in demonstrating phosphorylation of hexoses in P. fluorescens, it was of considerable interest to determine how the mannose polysaccharide could be synthesized.

Pertinent to the problem of the mechanism involved in the production of this polysaccharide are certain studies involving resting cells.

In the first place, it was determined that mannose oxidation was dependent upon adaptive enzymes, and significant oxidation of mannose does not occur with glucose or fructose grown cells. Fructose is similarly adaptive, and mannose grown cells have comparable oxidation rates in both mannose and fructose. This indicates that mannose metabolism may involve fructose as an intermediate. This, in view of evidence with other systems and structural considerations, is not unlikely. Whether phosphorylated intermediates or the hexoses as such are involved is unknown. Whichever is the case, mannose, fructose, and glucose are very closely related metabolically and in the order given.

Mannose, however, with cells from 2 day mannose cultures, in contrast to glucose and fructose, is oxidized to a significantly lesser extent and with a rapidly falling rate. In the presence of M/2000 2,4-dinitrophenol, these differences were abolished and mannose oxidation paralleled that of fructose and glucose both in rate and extent of oxidation. Glucose oxidation was essentially uneffected by this inhibitor, while fructose oxidation was influenced to a small degree. These results suggest that the assimilation evident with mannose is due to at least two processes; one is common to fructose and glucose, and the other, which is sensitive to this concentration of 2,4-dinitrophenol, is peculiar to mannose. In view of the nature of the Pseudomonas polysaccharide described, and the peculiar behavior of mannose in the respiration experiments, it is certainly tempting to consider them both as one process. It has not as yet been shown that a mannose polysaccharide is produced during the oxidation of mannose by the resting cells.

In our experience, and to our knowledge, no one has been able to demonstrate phosphorylation of hexoses by P. fluorescens or P. aeruginosa either in whole cells or enzyme preparations. However, the above results clearly suggest that phosphorylation of mannose may occur. Permeability could well be responsible for failure with whole cells, while the lack of active extracts could be due to technical difficulties.

The problem of polysaccharide synthesis from acetate cannot be explained as simply as from mannose. In the first place, mannose itself does not appear to be an intermediate, since acetate grown cells, cells actively synthesizing the polysaccharide in culture, have no activity on mannose. 2,4-dinitrophenol does not increase the extent of oxygen uptake on acetate grown cells. This may mean either that the mannose polysaccharide was not being synthesized by the resting cells or it was being synthesized by a mechanism less sensitive to 2,4-dinitrophenol than that leading from mannose. We cannot as yet tell. However, it seems most likely that the formation of the polysaccharide from acetate leads through a series of reactions yielding the phosphorylated derivative.

SUMMARY

Pseudomonas fluorescens OSU 64 was observed to produce rather large amounts of polysaccharide when grown in a simple medium composed of salts, 0.3 per cent yeast extract, and a low molecular weight compound as the source of carbon and energy. These carbon compounds included acetate, pyruvate, citrate, succinate, fumarate, malate, malonate, formate and glycerol. A yield of approximately 10 per cent was observed.

Polysaccharide was not produced in large amounts when glucose, mannose, pentoses, sucrose, or dextran were used as the carbon source under the conditions first described. Large amounts of polysaccharide would form from these sugars, however, if the medium were made alkaline and 1 per cent KCl, other potassium salts, or NaCl were added.

Hydrolysis of this polysaccharide yielded a sugar which was identified as mannose. The identification of this sugar was accomplished by the usual chemical techniques, such as paper strip chromatography, melting points of phenylhydrazine derivatives, optical rotation, and various color reactions, and by the study of adaptive enzymes. The presence of other sugars was not detected; this indicated that the polysaccharide was composed solely of mannose.

The conditions under which polysaccharide was produced were studied. There was evidence that an alkaline pH and salts of potassium and sodium favored production of the enzyme controlling the formation of polysaccharide. This finding explained, at least partially, why this carbohydrate did not form to a larger extent when the organisms were grown on such substrates as glucose, mannose, pentoses, etc., in a simple mineral-salts medium at a neutral pH.

Capsules were demonstrated for those organisms that had formed polysaccharide.

Pigment was shown to be produced in the presence of certain carbon compounds and not produced when other carbon compounds were used.

It was found that polysaccharide could be best removed from the medium by precipitation with equal volumes of ethanol. The medium was first agitated by means of a Waring blendor, and the cells were removed by centrifugation.

The polysaccharide appeared to be a high molecular weight structure with a branching configuration. This was

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shown to be analogous to the mannan formed by yeast. This is in contrast to the linear type of mannan produced by the ivory nut.

An attempt was made to explain metabolically how this complex polysaccharide could be formed from such simple carbon sources. There was indirect evidence to suggest that these cells could phosphorylate mannose and that polysaccharide was formed from these mannose phosphate units. It was further suggested that, starting with a carbon source such as acetate, mannose phosphate could be formed from the condensation of two 3-carbon compounds, such as glyceraldehyde-3-phosphate and pyruvate.

Microfilm $2.00; Xerox $3.00. 47 pages.

Abstract published by special arrangement with The Ohio State University.

CHARACTERIZATION OF A PIGMENTED YEAST AND ITS SLIME

(L. C. Card No. Mic 59-2684)

Stephen Joseph Gagan, Ph.D.
The University of Tennessee, 1959

Major Professor: J. Orvin Mundt

The organism employed in this study was a strain of yeast isolated from rotting redwood. It produces an unidentified dark green intracellular pigment and copious quantities of extracellular polysaccharide slime of infinite dispersion.

Slimes were produced from culture media containing such varied carbon sources as hexoses, pentoses, disaccharides, sugar alcohols, glycerol and sodium acetate. Stationary cultures yielded slime in amounts equivalent to that obtained by shaker cultures although the latter produced more cells and pigment.

The purified polysaccharide contained ca 1.9 per cent N, 0.8 per cent P and 16 per cent non-carbon ash. Ultraviolet analysis indicated the absence of protein and nucleic acid. The anthrone carbohydrate test indicated 79 per cent reducing activity when expressed as glucose.

Infrared spectrophotometric analysis produced a spectrum resembling that of glycogen. An absorption peak at 840 cm^{-1} indicated an α-configuration whereas absorption peaks at 930 cm^{-1} and 758 cm^{-1} suggested a predominantly 1:4 linkage. This is in contrast to typical bacterial dextrans which possess 1:6 linkages.

Hydrolysis of the polysaccharide was accomplished with 1 N sulfuric acid at 120 C for a period of 24 hours. The hydrolysate was ninhydrin negative indicating the absence of amino sugars. Dische's carbazole reaction for hexuronic acids was negative and Kapp's method for the microestimation of uronic acids in the unhydrolyzed polysaccharide was also negative. In addition, Tauber's test for pentoses and Saliwanoff's test for keto sugars were negative.

Time of osazone formation and melting point determinations verified the sugar as glucose.

Analysis of the slimes produced from four other carbon sources, e. g. mannose, glucose, xylose and glycerol indicated that their composition was identical.

If one disregards the difference in the physical manifestation of the extracellular material, a relationship may exist between our yeast and members of the Cryptococcaceae. The starch-like capsule produced by Cryptococcus neoformans exhibits a preponderance of α-links and has been classified as an unbranched 1:4 glucosan. Some of the members of the genus Cryptococcus are known to secrete a starch-like compound into the medium but only under appropriate conditions of pH. The fact that no place has been allowed the dark pigmented yeasts in the family Cryptococcaceae, however, prevents definite assignment of this organism.

Microfilm $2.00; Xerox $3.00. 51 pages.

CONDITIONS AFFECTING THE VIABILITY OF AIRBORNE SERRATIA MARCESCENS EXPOSED TO NEAR-ULTRAVIOLET IRRADIATION

(L. C. Card No. Mic 59-2791)

Charles Wesley Griffin III, Ph.D.
University of Maryland, 1959

Supervisor: Dr. Michael J. Pelczar, Jr.

The present investigation was undertaken to study conditions affecting the viability of airborne bacteria exposed to near-ultraviolet irradiation. A small cloud-chamber technique was used which consisted essentially of the irradiation of bacterial aerosols in one-liter flasks made of Vycor 7910 glass. Cell concentrations of Serratia marcescens in the flasks were determined by employing a slit sampler. A bank of RS 275 watt sunlamps was employed as the radiation source utilizing a Corning 7-51 filter for the isolation of the 3000 to 4000 A region of the spectrum (principally the 3650 A line).

The nature of the cell-suspending fluid, from which the cells were aerosolized, had a profound influence on the decay of the airborne cells. At humidities in the region of 10 per cent, compounds such as sodium ascorbate, sodium dehydroascorbate, glucose, and lactose afforded protection; whereas, the decay of cells aerosolized from distilled water or saline was rapid. Furthermore, the cell-suspending fluid appeared to have a greater influence on decay than the nature of the culture medium. A "humidity effect" was observed in that the decay of cells at 80 per cent humidity was considerably less than at 10 per cent humidity. Washing of cells prior to irradiation at 80 per cent humidity increased their decay; this effect could be counteracted by sodium ascorbate. The results of studies concerning irradiation in air and in an argon atmosphere suggested that at least part of the detrimental effect of near-ultraviolet irradiation was by oxidation.

Microfilm $2.00; Xerox $6.60. 140 pages.

THE BACTERIAL OXIDATION OF BENZENE

(L. C. Card No. Mic 59-2899)

Eleanor Kirk Marr, Ph.D.
The Pennsylvania State University, 1959

Organisms which utilize benzene as the sole source of carbon were isolated from the soil. The two most active isolates were tentatively identified as Pseudomonas aeruginosa and Mycobacterium rhodochrous. Cell growth of both organisms in benzene-mineral salts broth approached 10^9 cells/ml in 48 hours. Manometric studies were made on benzene-grown organisms using various substrates. Experiments with intact cells showed that the organisms oxidized benzene to carbon dioxide and water. Catechol also was oxidized to carbon dioxide and water and was attacked adaptively by cells grown in nutrient broth, indicating that catechol is a probable intermediate in benzene oxidation. Cells grown on benzene also oxidized succinate and acetate. Pseudomonas aeruginosa cells oxidized β-ketoadipic acid.

Cell extracts were prepared from benzene-grown cells by sonic oscillation and grinding with glass beads. These preparations did not oxidize benzene, succinate or acetate. With catechol sufficient oxygen was consumed to quantitatively account for the addition of one molecule of oxygen per molecule of catechol.

In addition to manometric data, other evidence was obtained for certain intermediates in the breakdown of benzene. During growth of both cultures the pH dropped below 6.0 in 48 hours and a positive catechol test was occasionally observed with Pseudomonas aeruginosa. Catechol and succinate were recovered by ether extraction of the growth medium and were identified by paper chromatography. Evidence for cis-cis muconic acid was obtained from spectrophotometric studies of disrupted cell preparations on catechol. Large scale resting cell suspensions shaken with catechol as substrate produced a negative catechol test and showed an intense Rothera reaction after four to 24 hours, indicative of β-ketoadipic acid formation. Growth experiments using possible intermediates as sole carbon sources showed that growth could occur using β-ketoadipic acid as a substrate. Phenol could serve as a carbon source for Mycobacterium rhodochrous but not Pseudomonas aeruginosa. Data presented suggested that neither phenol nor o-benzoquinone were intermediates in benzene oxidation. A pathway of benzene oxidation was proposed. Microfilm $2.00; Xerox $4.80. 92 pages.

A STUDY OF CELLULASE PRODUCTION BY CERTAIN FUNGI

(L. C. Card No. Mic 59-2673)

John S. Seo, Ph.D.
Syracuse University, 1959

This investigation was primarily concerned with determining the optimal nutritional and environmental conditions for production of cellulase by the fungi Myrothecium verrucaria, Polyporus palustris and Trichoderma viride.

Routinely, cultures were grown in 80-ml culture medium in 250 Erlenmeyer flasks, incubated at 28°C on a reciprocating shake machine.

Cellulase activity was measured routinely as reducing substances (expressed as glucose) produced by action of the enzyme on soluble cellulose (carboxymethyl cellulose); insoluble cellulose (filter paper) also was used as the substratum for testing cellulase activity.

The cellulase of each organism appears to be a relatively stable extracellular enzyme. It can be stored for several months at 4°C without any apparent loss in activity. The enzyme was found to be active over a fairly wide temperature range and pH range.

There were a number of similarities among the three test organisms as regards cellulase production. All three organisms produced cellulase best in an initially acid medium, and which had an Eh of approximately +400 mv to +250 mv. The minimum nutrients included an energy source (cellulose), any one of a number of nitrogen sources (organic and inorganic), and the usual minerals---potassium, magnesium, phosphorus and sulfur. In addition, the presence of trace quantities of several other elements appeared to be important in cellulase production.

Cellulase appears to be an adaptive enzyme in the three test organisms. It was produced in measurable amounts when the organisms were grown in cellulosic media but not in media lacking cellulose.

Various inexpensive materials, e. g., soy bean meal, were investigated as possible substrates for cellulase production by the three test organisms. The inexpensive materials found favorable as substrates for cellulase production generally required the addition of cellulose for best results.

A preliminary study was made of the production of cellulase in 1-liter-volume shake culture as well as in a small fermentor (4-liter-volume), compared with the standard 80-ml-volume shake culture. Cellulase production in the 1-liter-volume shake culture was found to be comparable to cellulase production in the 80-ml-volume shake culture. The poor cellulase production in the small fermentor is considered to be due to unfavorable conditions (aeration and/or agitation rates) within the fermentor.

In a preliminary study of methods for concentrating cellulase from the culture liquor, precipitation with the common organic solvents rendered satisfactory results. Moreover, it was found that the cellulase of each organism could be concentrated by solvent precipitation over a fairly wide pH range. The apparent activity (tested against cellulose) of the cellulase in the original culture medium depended upon whether the cellulose used was soluble or insoluble. Following solvent precipitation of the enzyme from the culture fluid, there appeared to be differences in percentage recovery of the cellulase again depending upon the nature of the cellulose substrate.

Microfilm $2.00; Xerox $5.20. 102 pages.

RADIOSENSITIVITY OF BACTERIAL SPORES

(L. C. Card No. Mic 59-1209)

John Heyward Wynn, Jr., Ph.D.
Syracuse University, 1958

In recent years research has shown both the effectiveness of utilizing ionizing radiations to destroy microorganisms and the feasibility of radiation for the sterilization of foods. One of the major problems often encountered

in the radiation sterilization of foods is the development of undesirable effects such as off taste, off odor, etc, due to the relatively high radiation doses required. One approach to this problem would be the sterilization of foods at low radiation doses, if appropriate chemical agents could be found which have a synergistic or supplementary activity with ionizing radiations in the killing or microorganisms in food.

The aim of this work is to find a suitable combination of chemical with ionizing radiation that will permit the sterilization or preservation of foods such as fluid milk and fresh meats. At the same time the determination of some of the environmental and metabolic factors involved in radiosensitivity of bacterial spores was undertaken.

Sensitivity of spores to the combined lethal action of compound and x-ray was evaluated on the basis of the per cent of spores killed due to 1) chemical alone, 2) x-irradiation alone, and 3) combination of compound and x-irradiation.

A number of compounds were found to be synergistic or complementary with x-irradiation in the inactivation of spores of Bacillus cereus, B. subtilis, and B. thermoacidurans. The synergism involving ethylene oxide was studied in some detail using B. thermoacidurans and B. subtilis. Alpha-amino-n-butyric acid was synergistic with radiation on B. cereus spores. S,beta-aminoethylisothiouronium bromide·HBr consistently showed radiation enhancement on B. subtilis spores.

Some of the compounds that were complementary with x-irradiation in the inactivation of spores were: sorbic acid, hydrogen peroxide and ferrous sulfate in combination, 1,2-propanediol, propylene oxide, benzylalkonium chloride, p-hydroxybenzoic acid and beta-propiolactone.

B. subtilis spores were more radioresistant than those of B. cereus or B. thermoacidurans; the respective D_o values were about 150,000, 80,000 and 50,000 rep.

Fluid milk and fresh meats were sterilized by combined radiation and ethylene oxide treatment using 100,000 rep or less of ionizing radiation. While the sterilized foods were normal in appearance and taste, no attempt was made to determine their wholesomeness.

The radioresistance of catalase, glutamic-pyruvic transaminase, glutamic-oxalacetic transaminase, as well as lactic and succinic dehydrogenase enzymes were studied in B. subtilis cells undergoing endogenous sporulation. Of these enzymes catalase activity alone did not decrease with shaking in distilled water up to 8 hours. Catalase as well as the transaminases (glutamic-pyruvic and glutamic-oxalacetic) were not affected by 20,000 or 160,000 rep, respectively.

Succinic dehydrogenase activity with 20,000 rep was constant in the 0 hour and the 4 hour cells.

Lactic dehydrogenase in cells immediately after harvest was more sensitive to x-rays than the enzyme after an additional 4 hour period of shaking in distilled water.

Microfilm $2.00; Xerox $6.60. 138 pages.

INTERSPECIFIC HYBRIDIZATION, GENE TRANSFER, AND CHROMOSOMAL SUBSTITUTION IN NICOTIANA

(L. C. Card No. Mic 59-2511)

James Ferris Chaplin, Ph.D.
North Carolina State College, 1959

Supervisor: Dr. Thurston Jefferson Mann

This study was undertaken to obtain experimental evidence on the advantages of using an autotetraploid (8x) N. tabacum as a parent in interspecific hybridization. The second objective of the study was to gain information on the relative ease of chromosomal substitution and interspecific gene transfer to N. tabacum from other Nicotiana species. Attempts were made to cross the following Nicotiana species with autotetraploid N. tabacum: N. otophora, N. tomentosiformis, N. glutinosa, N. paniculata, N. knightiana, N. glauca, N. rustica, N. alata, N. langsdorffii, N. sylvestris, N. plumbaginifolia, N. pauciflora, N. bigelovii, N. trigonophylla, N. palmeri, N. nudicaulis, N. undulata, N. nesophila, N. suaveolens, N. debneyi, N. megalosiphon, N. occidentalis, N. benthamiana, and N. eastii. Estimates of cross-compatibility between autotetraploid N. tabacum and the above Nicotiana species, the viability, and fertility of the hybrids were obtained.

The cross-compatibility obtained when an autotetraploid N. tabacum was used in the initial cross with diploid Nicotiana species, was compared with that reported in the literature when diploid N. tabacum was used. In most cases the cross-compatibility between autotetraploid N. tabacum and the species was the same as that reported when diploid N. tabacum was used, except for the N. rustica population. N. rustica could only be used as the female in the initial cross with autotetraploid N. tabacum, however, the cross-compatibility between N. rustica and N. tabacum was greatly increased by the use of an autotetraploid rather than a diploid N. tabacum.

A hybrid between autotetraploid N. tabacum and one of the diploid Nicotiana species was designated as a sesquidiploid. There was a range of behavior, as to the viability of the sesquidiploid plants, involving different Nicotiana species. Some of the seedlings died soon after germination, some continued to die throughout the life cycle, and others grew vigorously to maturity. From the 24 species crosses attempted, mature sesquidiploids with N. tabacum, were produced with 13.

All the sesquidiploids, with one exception, had enough fertility, either male or female, to produce progenies by backcrossing. The sesquidiploid involving N. alata was both male and female sterile.

To study chromosomal substitution and interspecific gene transfer, two marker stocks of N. tabacum were used. One was the (yg) factor from Consolation, and the other was the (yb) factor from Burley. There was little difficulty

involved in transferring the (Yg) factor from N. sylvestris, N. otophora, and N. tomentosiformis into N. tabacum. Homozygous (Yg) lines were obtained in the BC_1 F_3 generation from each of the populations involving these species. It was equally easy to transfer the (Yb) factor from N. sylvestris to N. tabacum.

The data presented indicated that a substitution of a chromosome carrying the (Yg) factor from the following species into N. tabacum occurred: N. paniculata, N. plumbaginifolia, and N. rustica. The segregation ratios obtained, when the substitution heterozygotes were self-pollinated, indicated little or no pairing between the alien chromosome and its N. tabacum counterpart.

Since reciprocal crosses could not be made it was necessary to use three of the Nicotiana species as the female in the initial cross with autotetraploid N. tabacum. These species were: N. rustica, N. bigelovii, and N. suaveolens. There was a different reaction as to the formation of anthers and staminal sterility involving each of these species with N. tabacum. All of the plants in the N. bigelovii population were staminal sterile, after the first backcross of the sesquidiploid to diploid N. tabacum, using the sesquidiploid as the female. The staminal sterility was manifested by the anthers appearing as "petal-like" structures.

In the BC_1 population from the sesquidiploid involving N. suaveolens, using the sesquidiploid as female, there was a segregation for staminal sterility. This staminal sterility was manifested by the anthers appearing as "pistil-like" structures. The ratios between staminal sterile and normal plants in this population, indicated univalent transmission.

There were no abnormal flowers produced in the N. rustica population, although the N. rustica cytoplasm was retained through three backcrosses.

Microfilm $2.00; Xerox $6.20. 129 pages.

THE GENETIC AND ENVIRONMENTAL RELATIONSHIPS BETWEEN REPRODUCTIVE TRAITS AND BODY MEASUREMENTS IN TURKEYS

(L. C. Card No. Mic 59-2513)

Robert Edward Cook, Ph.D.
North Carolina State College, 1959

Supervisor: Edward Walker Glazener

Data on body weight, breast width, egg production, percent fertility and percent hatchability from over 3000 Broad Breasted Bronze turkeys were analyzed to estimate the genetic, environmental, and phenotypic relationships between the traits. Heritability estimates were computed and selection indexes constructed to give optimum emphasis to each of the traits in a selection program.

Genetic correlations between the reproductive traits were small but larger than the corresponding environmental correlations. The estimates of the genetic and environmental correlations were approximately 0.20 and 0.10, respectively. Body weight and breast width were highly correlated genetically (0.50). Phenotypic correlations between the reproductive traits and body measurements indicate that the traits are negatively related. Genetic correlations between the reproductive traits and body measurements were small but varied considerably. The estimates between egg production and the body measurements were near zero indicating little or no genetic relationship between the traits. Fertility was positively correlated with both body measurements, while the relationship between hatchability and the body measurements tended to be negative. The magnitude of these correlations was small.

Heritability estimates computed for the traits were approximately 0.20 for egg production, 0.17 for both fertility and hatchability, 0.40 for body weight and 0.24 for breast width.

Selection indexes were constructed to select for each trait individually and to select for the aggregate of all traits assigning economic weights to the individual traits.

Microfilm $2.00; Xerox $5.60. 112 pages.

CAUSE AND MODE OF INHERITANCE OF MALE STERILITY IN FOUR MUTANTS OF TOMATO (LYCOPERSICON ESCULENTUM MILL.)

(L. C. Card No. Mic 59-2741)

Warren Robert Henderson, Ph.D.
The Ohio State University, 1959

Four male-sterile tomato mutants, which were designated by the gene symbols bn, cl_3, sl(?), and ps?, were found in the varieties Purdue F_2, Red Jacket, Ohio W-R Jubilee, and Big Early Hybrid. A genetic study was conducted with each mutant to determine the mode of inheritance, to establish or disprove a linkage relationship with the gene for potato leaf shape (c) and the gene for uniform unripe fruit color (u), and to test the identity of the four mutants. A detailed description was given for each mutant, and the phenotypic stability was evaluated from field and greenhouse tests. The cause of unfruitfulness was resolved by studying the relationship between floral abnormality and unfruitfulness.

A total of 5,363 plants of the P_1, P_2, F_1, F_2, and BC generations were observed during the years 1956, 1957, and 1958 at the University Greenhouses and the Horticultural Farm of The Ohio State University, Columbus, Ohio.

All F_1 plants contained normal, fertile flowers, cut leaves, and fruits that were of a non-uniform unripe color.

Segregation in the F_2 and BC generations showed that each mutant was governed by a single recessive gene. There was no indication that an allelic relationship existed between the four mutants. However, it did appear that ps? was probably identical with the ps mutant reported by Larson and Paur.

Mutants bn, cl_3, and sl(?) were each found to assort independently of gene c and gene u, and would therefore not be located in linkage group IV or VII, or if in either linkage group they would be sufficiently far apart to assort independently. Furthermore, dihybrid segregation was indicated for the male-sterile genes bn and sl(?).

A mutant bn plant usually contained flowers that were stamenless. Occasionally functional stamens were found during late spring in the greenhouse. They were often adnate to the pistil, causing a scarring of the fruit. The gynoecium was defective, which, in part, could be related

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to a twisted, grooved, and bent style with a reduced stigmatic surface. The leaves were obovate in form, margins nearly entire, and when compared with either a cut leaf or a "potato" leaf, bn leaves were more broad and blunt. A delay in flowering occurred, resulting from an increased node number to the first inflorescence. A night temperature of 50 degrees Fahrenheit for one and one-half weeks following germination, and "direct seeding," effected a reduction in the bn node number. However, fertile and sterile plants were still distinguishable on the basis of a difference in node number.

Flowers of cl_3 plants did not open in the usual fashion; the petals were pale yellow in color and remained vertical to the floral axis. The fruit possessed a prominent protuberance at the stylar end. Unfruitfulness in this mutant was attributed to a pre-mature exertion of the stigma, which produced a barrier to self-pollination. A partial breakdown of this barrier occurred late in the season, under field conditions, which was related to lower temperatures.

The effect of sl(?) was confined to the flower. Stamen number was reduced and the petals were slender and a green-yellow in color. Although stamenless flowers were found, they were not as numerous as in bn.

The features which were associated with each of the three mutants were inherited as a Mendelian unit, and probably represented a pleiotropic effect of the mutant gene. Microfilm $2.20; Xerox $7.80. 166 pages.

DETECTION OF LOCUS-MUTAGEN INTERACTIONS BY THE NEUROSPORA BACK-MUTATION TECHNIQUE

(L. C. Card No. Mic 59-2956)

Jimmie Bob Smith, Ph.D.
Cornell University, 1959

Five auxotrophic mutants of Neurospora crassa, which had originated from the same forward mutation experiment involving treatment of wild-type 73a conidia with beta-propiolactone, were identified as requirers, respectively, of adenine (mutant, 58 purple), adenine (mutant 65, non-purple), arginine (mutant 65), leucine (mutant 61) and choline (mutant 02).

These auxotrophic mutants were singly combined with a morphological mutant, Ex2-67, to give double mutant auxotrophic colonials. The back-mutation rates for returned prototrophy were studied by employing the Neurospora back-mutation test. In addition to ultra-violet irradiation, three chemical mutagens, namely, beta-propiolactone, diepoxybutane, and dimethyl sulfate were studied for their effect on back-mutation rates.

Two strains, 5867 and 6567, gave no spontaneous mutations. However, strain 5867 responded to treatment with dimethyl-sulfate but not the other mutagens. Strain 6567 responded only to ultra-violet. The other strains showed varying degrees of difference in quantitative response to the mutagens.

The possibility of suppressors has not been eliminated but adaptation did not appear to be involved, nor was competitive suppression ("Grigg effect").

Microfilm $2.00; Xerox $3.80. 67 pages.

THE QUANTITATIVE GENETICS OF THE TIME OF VAGINAL OPENING IN THE HOUSE MOUSE, MUS MUSCULUS

(L. C. Card No. Mic 59-2567)

Chai Hyun Yoon, Ph.D.
The Ohio State University, 1953

It is a well established genetic principle that the variation in true breeding strains and that in the first hybrid generation F_1 between them are nongenetic. It has also been supposed that this nonheritable variation of F_1 should be of the same magnitude as that of its parental strains and that where the nonheritable variation of F_1 differs from that of parental strains, the former should exceed the latter. East[1] quoted Castle as saying that greater variation should be expected in the F_1 generation than in the parental generation when crossing widely deviating individuals showing variation which is apparently continuous.

Mather[2] showed methods of analysis of quantitative characters. His methods were based upon an assumption that the variation of true breeding parental strains and their F_1 must be exclusively nonheritable and that the magnitude of the nonheritable variation in them should be equal within the limit of sampling error.

However, results contrary to these statements and assumptions were observed by the author in the study of the time of vaginal opening in the house mouse, Mus musculus. It was found that the nonheritable variation in F_1 was much smaller than that in true breeding parental strains. The nonheritable portion of the variation of the other generations such as the second hybrid generation F_2 and the first and the second backcross generations was also found to be significantly smaller than the variation of the parental strains when the nonheritable portion of the variation was estimated from that of the parental strains.

Results similar to the author's have been reported previously by several investigators. Livesey[3] found in rats that both F_1 and F_2 were less variable in body weight than parental strains. Mather[2,4] found that the variances of F_1's were much smaller than those of inbred parental strains in crosses between Petunia axillaris and P. violacea and in crosses between varieties of Primula sinensis. Rasmusson,[5] Robertson and Reeve,[6] Reeve and Robertson,[7] and Dobzhansky and Wallace[8] reported similar results in Drosophila.

Three long inbred strains of mice, BALB/c, NB, and C57BL/10 (=C57BL), were used as experimental materials. Mice of these strains were obtained from the sublines maintained at The Ohio State University genetics laboratory.

All the mated mice were kept under as similar conditions as possible. They were checked once each day for litters. As soon as a litter reached the age of 10 days, the vagina of each female was examined daily thereafter. The time of vaginal opening was computed from the day of birth to the day of its opening.

Crosses were made between NB and C57BL, and between BALB/c and C57BL. The cross between NB and C57BL was designated as cross 1, and the cross between BALB/c and C57BL as cross 2. The mating system for these crosses is shown in figure 1, together with symbols for the various generations.

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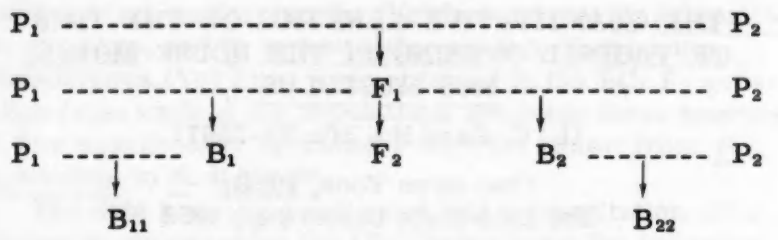


Figure 1
Mating system

In cross 1, NB was designated as P_1 and C57BL as P_2. In cross 2, BALB/c was designated as P_1 and C57BL as P_2.

The experiment was begun in May, 1952, and was concluded in June, 1953. During this period a total of 1679 female mice were examined. The numbers in the various generations are shown in table 1 with the mean number of days needed for the time of vaginal opening. Not all of the 1679 female mice are included in the table since some of them will not be discussed.

Table 1

Number of mice examined in various generations in cross 1 and cross 2 with means for various generations
In cross 1, P_1=NB, P_2=C57BL;
in cross 2, P_1=BALB/c, P_2=C57BL

Generation	Cross 1			Cross 2		
	Number of mice	Mean $\bar{x}$	$s_{\bar{x}}$	Number of mice	Mean $\bar{x}$	$s_{\bar{x}}$
P_1	86	24.640	0.872	145	22.193	0.659
P_2	111	36.712	0.754			
F_1	47	29.298	0.652	192	34.797	0.326
F_2	183	29.907	0.399	163	30.736	0.467
B_1	108	29.500	0.625	107	26.738	0.680
B_2	118	31.619	0.423	74	33.811	0.488
B_{11}	49	32.490	1.049			
B_{22}	88	34.375	0.718			
Subtotal	790			681		
Grand total	1471					

Test of difference between parental strains

Since no reason was found to suspect that three parental strains are not homozygous within strains, the data were pooled for each strain for the tests of difference of means and variances. From these tests it was found that the differences between the means of NB and C57BL, and between the means of BALB/c and C57BL are significant, but the variances of these strains do not differ from each other beyond the limit of sampling error. The differences between means of strains were interpreted as being genetic differences.

Factors which may affect the time of vaginal opening

Several factors which may affect the time of vaginal opening were tested. From these tests it was found that the age of parents has no effect but that the size of litter has considerable effects upon the character. No marked genetic correlation was found between the character and the body weight. Litter mate correlation was found to be rather high in parental strains and their F_1's. It was decided, however, that these factors do not affect the analysis of means and variances; therefore, they were not considered in the analysis. No difference was found between reciprocal F_1's.

Effects of season

It was found that the change of season has considerable effects upon the time of vaginal opening. In order to remove these seasonal effects the data were fitted with a sine curve and a sine-cosine curve, the formulas of which are:

$$\hat{Y} = f \sin X + g \cos X + h,$$
$$\hat{Y} = f \sin X + h.$$

In the sine-cosine curve, the quantities f and g determine the amplitude and origin of the curve, and in the sine curve, the quantity f determines the amplitude, with the origin being assigned a priori. The h is a constant around which the curve repeats its cycle; therefore, it was taken as the grand mean (or simply mean) of the curve.

Tests of adequacy of scale with means of various generations

The means of various generations of cross 1 and cross 2, after the removal of seasonal effects with the use of the sine curve, are shown in table 2.

Table 2

Adjusted means or values of h's for P_1, P_2 and subsequent generations in cross 1 and cross 2

Generation	Adjusted means or h's					
	Cross 1			Cross 2		
	h	s_h	df	h	s_h	df
P_1	24.803	0.856	83	21.054	0.651	142
P_2	34.039	0.700	108	34.939	0.700	108
F_1	30.154	0.620	44	32.340	0.673	189
F_2	29.279	0.440	180	28.741	1.058	160
B_1	27.731	0.800	105	25.895	1.554	104
B_2	30.822	0.422	115	31.346	0.988	71
B_{11}	29.396	1.413	46			
B_{22}	31.353	0.739	85			

With these means, comparisons were made between various generations in each cross. Such comparisons have the following significance: they give indications as to the

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adequacy of the scale used, and they give information concerning the presence or absence of dominance. For such tests methods described by Mather[1] were used.

The results of the tests showed that the scale used is adequate and that there exists dominance in P_2 of cross 2.

Analysis of variance

The variances of the various generations of cross 1 and cross 2, after the removal of seasonal effects, are shown in table 3. As seen in the table, the variances of the F_1 generations are much smaller than those of parental strains. Since animals of these generations are identical or nearly identical as to their genetic components within generations, these variances were interpreted as caused by environmental agencies, and were designated therefore, as nonheritable variances. The nonheritable portion of the variances of the other generations such as F_2, B_1, B_2, B_{11}, and B_{22}, when estimated from the nonheritable variances of the parental strains were found to be much smaller than expected.

Table 3

Adjusted variances for P_1, P_2 and subsequent generations in cross 1 and cross 2

Generation	Adjusted variance	
	Cross 1	Cross 2
P_1	62.627	53.231
P_2	46.194	46.194
F_1	15.683	19.085
F_2	27.917	34.938
B_1	39.257	50.221
B_2	17.878	16.250
B_{11}	48.761	
B_{22}	30.341	

From these findings assumptions were made that the degree of heterozygosity of a generation is associated with its magnitude of nonheritable variance, and that the lesser the heterozygosity in a generation, the greater becomes the nonheritable variance of the generation.

These assumptions were tested by modifying the methods described by Mather.[2] The tests for both cross 1 and cross 2 were found to support these assumptions rather strongly.

From these findings it was concluded that the lesser variance of heterozygotes, compared to the greater variance of homozygotes, is an expression of the better ability of heterozygotes to maintain their own constancy among varying environmental conditions. In other words, heterozygosity was interpreted as one of the homeostatic agencies. Microfilm $2.00; Xerox $6.20. 128 pages.

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THE GREEN RING MOTTLE DISEASE OF MONTMORENCY SOUR CHERRY AND ITS CAUSAL VIRUS AS AN ENTITY DISTINCT FROM THE SOUR CHERRY RING SPOT AND YELLOWS VIRUSES

(L. C. Card No. Mic 59-2947)

Thomas Henry Barksdale, Ph.D.
Cornell University, 1959

Studies were made of the green ring mottle disease in order to find what relationship existed between its causal virus and viruses causing sour cherry ring spot and yellows. The inoculation studies were made by placing buds from diseased trees on healthy trees or on trees of known virus content.

The disease has two leaf symptoms, green rings against a yellow background and constricting chlorosis along a vein, and a fruit symptom with necrotic tissue in the flesh of affected fruits.

The spread of green ring mottle was slow and continuing in one orchard surveyed annually for seven years; instances of slow spread into healthy Montmorency plantings were also found. The spread was not related to the spread of ring spot or yellows.

Although green ring mottle virus usually occurs together with ring spot virus in nature, one instance of natural transmission in the absence of ring spot virus was observed. It has been transmitted experimentally both to Montmorency and to Kwanzan flowering cherry in the presence and absence of ring spot virus.

Inoculation with combinations of green ring mottle and ring spot viruses to sweet cherry, duke cherry, peach, and Italian prune failed to cause symptoms diagnostic for green ring mottle. Green ring mottle virus was recovered by inoculation to Montmorency from sweet cherry and peach.

Inoculation of English Morello sour cherry with green ring mottle plus ring spot viruses failed to cause the development of immature, pointed fruit as suggested previously in the literature.

Green ring mottle virus does not cause a local bark necrosis reaction around buds inserted on Shirofugen oriental flowering cherry, but does cause a veinal-necrosis and leaf-twisting symptom on Kwanzan. Viruses causing ring spot, yellows, line pattern, and prune dwarf failed to cause this latter symptom on Kwanzan.

The green ring mottle virus can exist in multiple infections in Montmorency with one or more of the viruses causing ring spot, yellows, line pattern, prune dwarf, and vein-clearing rosette without there being any marked enhancement or suppression of the symptoms caused by any of these viruses; a severe strain of the vein-clearing rosette virus appears to mask green ring mottle symptoms during the second growing season after inoculation.

On trees containing both green ring mottle and ring spot viruses, the green ring symptom was more severe on trees experimentally shaded from bud-break than it was on unshaded trees.

Temperatures maintained between 70° and 75°F while the green ring symptom was developing encouraged its development whereas cooler temperatures did not.

When seedlings grown from seed of diseased and healthy sweet or sour cherry trees were indexed on shoots of both Kwanzan and Shirofugen cherry, no evidence for the seed transmission of green ring mottle virus from trees doubly infected with green ring mottle and ring spot viruses was obtained; only ring spot virus was so transmitted.

Reasons are discussed for considering the virus causing green ring mottle as distinct from the viruses causing ring spot and yellows.

Microfilm $2.00; Xerox $5.00. 97 pages.

ROOT-GRAFTS IN EASTERN WHITE PINE, PINUS STROBUS L.: THEIR OCCURRENCE AND ECOLOGICAL IMPLICATIONS

(L. C. Card No. Mic 59-2383)

Benjamin Franklin Graham, Jr., Ph.D.
Duke University, 1959

Supervisor: Henry J. Oosting

Natural root-grafts among forest trees have been known since the time of Theophrastus. Until very recently, however, they have been considered principally as botanical curiosities to which the occasional continued growth and healing-over of stumps could be attributed. That root-grafts are more common than has been generally suspected is indicated by a tabulation of nearly 70 tree species in which they have been observed. To study their characteristics and ecological implications in eastern white pine, 85 experimental plots were established in 5 stands in New Hampshire. The stands, 15, 19, 27, 39, and 55 years of age, represented a wide range of subsoil drainage conditions. An experimental (donor) tree, which established the center of each circular plot, was felled, and, about the top of its stump, a stout watertight collar was constructed. Tracer solutions were poured into the collars whence they moved, through the sapwood, by way of root-grafts, into the sapwood of adjacent trees. Dye, 0.15 per cent aqueous acid fuchsin, moved to 44 different receptor trees from 32 of 70 donors injected. Four fresh stumps, injected with iodine-131 solution, yielded negative results, apparently due to a chemical blockage. Of 11 rubidium-86-injected stumps, 7 were fresh, and 4 were old and partially decayed. The rubidium was transferred from 5 of the 7 fresh stumps to 7 receptor trees, and, of the 4 rotten stumps, 3 had roots which were still functional in the root complex. In the 55-year old stand, approximately 60 per cent of the

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old stumps examined had live roots, and, in a 71-year old stand in Maine, 42 per cent of the visible stumps were still participating in the live-root network.

In one instance, where dye transfer had shown two trees to be grafted to the donor stump, partial excavation disclosed a root-complex involving at least 6 trees; and 35 separate intraspecific grafts were counted in less than half of the complex. It is concluded, therefore, that, while demonstrations of root-grafts by dye or isotope transfer are valid, they are almost certainly quantitatively underrepresentative.

Dye intake, into collared stumps, was most rapid during the first day following injection; and it tapered off to about 25 per cent of the initial rate after approximately 7 days. Near the end of this downward trend, one marked increase in daily dye intake coincided with weather conditions which were conducive to increased transpiration in the intact grafted trees. There was no demonstrable diurnal periodicity in intake rate, nor was there a statistically significant difference between day and night intake rates.

The average daily dye intake for 10 stumps over a 10-day period was 37.6 milliliters per square centimeter of sapwood. The highest rate, during the first 24-hour period, was 93.0 ml/cm^2 spwd, and the lowest, toward the end of the observation period, was 18.3 ml/cm^2 spwd.

It was shown that white pine roots will grow and graft under a wide range of subsoil drainage conditions, that grafts occur in plantations as well as in natural stands, and that abundant grafting may be found in pine from 15 to 71 years of age. Materials in solution can move, through root-grafts, from tree to tree, from freshly cut stumps to neighboring intact trees, and through the live sapwood on old stumps, long topless, to nearby host-trees to which the stumps remain grafted. Grafted pine stumps, cut in 1957, were still alive and had added a new annual ring in the spring of 1958, whereas stumps to which no grafts had been demonstrated were dead in 1958. The new growth on grafted stumps, as well as about the bases of some standing snags with grafted roots, was greatest in, and sometimes limited to, the area immediately above the grafted root or roots.

There is no doubt that natural root-grafts exist in great abundance. They probably play important roles in invasion, succession, competition, dominance and in the determination of community composition. Some of their many ecological implications are discussed.

Microfilm $2.00; Xerox $5.20. 101 pages.

A STUDY OF FUNGI INVOLVED IN ROOT ROTS AND SEEDLING DISEASES OF BIRDSFOOT TREFOIL

(L. C. Card No. Mic 59-2951)

John M. Kainski, Ph.D.
Cornell University, 1959

During 3 consecutive growing seasons, a survey of 81 fields in 13 counties of New York State was undertaken to determine what pathogenic organisms were associated with root rots of birdsfoot trefoil. Although no epiphytotic was noticed, a small percentage of plants in every field inspected showed stunting and discoloration of foliage. Diseased plants of various ages were collected from each field for examination of their root systems and for isolations. Roots of such plants almost invariably showed symptoms of rots, which were classified and described under the following headings: rot of fibrous roots, rot of pith proceeding from the crown, and rot of cortex of the primary root and of larger secondary roots. Isolations were made from 347 roots collected in the fields and from 168 diseased young seedlings grown in naturally infested soil in the greenhouse; 8051 portions of diseased root tissues were plated, and 4311 fungal isolates were obtained.

The rot of fibrous roots was most frequently associated with pathogenic isolates of Fusarium oxysporum, F. solani, F. moniliforme, F. roseum, and F. tricinctum. F. oxysporum, F. moniliforme and F. roseum was isolated most often from the pith. The cortical rot yielded Sclerotium bataticola, Rhizoctonia solani, Phialophora spp., and pathogenic species of genus Fusarium. Root rot and damping-off of young seedlings in the greenhouse were associated with F. oxysporum and Pythium spp.

All fungi were grouped according to morphological species, seasonal and geographical occurrence, resulting in 551 representatives which were tested for pathogenicity to germinated seedlings in sand culture in glass tumblers. Many isolates of F. oxysporum, F. solani, F. roseum, F. moniliforme and F. tricinctum and 1 isolate each of R. solani, S. bataticola, S. sclerotiorum and Phialophora spp. were highly virulent. The severity of other isolates varied. Several isolates of Penicillium, Trichoderma, Fusarium, 1 isolate of Spicaria violacea, and many not identified, although not highly virulent, caused some destruction and malformation of roots and basal part of the seedlings. It is believed that these fungi might predispose seedlings to infection by weak pathogens, thus influencing stand establishment under field conditions.

Forty-two pathogenic isolates and 2 nonpathogens selected on the basis of the test in glass tumblers were tested on plants of various ages in sterilized and nonsterilized soil. Fungi nonpathogenic to seedlings in sand culture were nonpathogenic to older plants in steamed and nonsteamed soil. Not all of the fungi pathogenic in glass tumblers would also infect plants under other conditions.

The larger number of pathogens inducing symptoms of root rots belong to genus Fusarium. F. oxysporum, F. roseum, F. moniliforme, and F. tricinctum caused rot of fibrous roots in steamed and unsteamed soil. F. oxysporum and F. roseum are able to infect leaves and stems under controlled conditions. As the consequence of this, the roots also can be infected through the stems.

Very virulent strains of Rhizoctonia solani and Sclerotium bataticola produced cortical rots of the roots. R. solani was pathogenic to roots of young and mature plants in steamed and nonsteamed soil. S. bataticola was not virulent to young seedlings in steamed and unsteamed soil, but its pathogenicity increased with increased age of the plants.

Fungi isolated during this investigation came from samples collected irregularly in different times of the growing season, from several places and under a variety of field conditions. Various parts of root systems with a variety of symptoms were used for isolations. On the basis of the results of studies reported here, it is believed

that many different species of fungi contribute to root rots of birdsfoot trefoil.

Microfilm $2.00; Xerox $3.80. 70 pages.

CULTURE OF EXCISED ANTHERS OF LILIUM LONGIFLORUM, (PART I). INCORPORATION OF TRITIATED CYTIDINE IN EXCISED ANTHERS OF LILIUM LONGIFLORUM, (PART II).

(L. C. Card No. Mic 59-2583)

Joan Hilda Dalheim Kosan, Ph.D.
Columbia University, 1959

Part I

The primary objective of this phase of the investigation was to develop a medium which would support the growth of excised anthers of Lilium longiflorum from pre-meiosis through the reduction division. Various nutritive and accessory substances, i.e. coconut milk, ribonucleic acid, desoxyribonucleic acid, kinetin, gibberellic acid, yeast extract, glutathione, amino acids, etc. were added to the basic mineral medium. A developmental analysis of sectioned anther material was made. In addition to using the Feulgen technique as a standard procedure, controlled Feulgen-fast green staining was employed to study the DNA and basic proteins in the same tissue preparations.

The results showed that microsporocytes in late leptotene-early zygotene or later stages of reduction division at the time of anther excision regularly complete meiosis when cultured. Cells in earlier stages of meiosis at the start of the culture period generally do not complete meiosis in vitro. Pre-leptotene cells rarely reach the division stages; earlier pre-meiotic microsporocytes generally do not survive pachytene.

Autoradiographic studies, (Part II), revealed that very little RNA was incorporated in the cytoplasm as microsporocytes progressed from leptotene to zygotene. These results and the findings from the culture experiments suggest that microsporocyte cytoplasmic metabolism is more or less completed by the time sporogenous cells reach late leptotene-early zygotene. These cells are apparently equipped to complete meiosis in vitro without the addition of any specific substances.

The developmental analyses also revealed that the tapetum regularly breaks down when the lily anthers are cultured. This undoubtedly influences post-tetrad microspore development.

The Feulgen-fast green stained material disclosed that degredation of DNA in cultured anthers was positively correlated with breakdown of basic proteins.

Part II

One application of the anther culture technique is the autoradiographic study of the incorporation and distribution of isotopic substances over extensive periods of time. Tritiated cytidine was used to investigate nucleic acid synthesis in sporogenous and tapetal tissues in anthers of Lilium longiflorum. The low energy beta particles emitted by tritium result in high resolution autoradiography.

After twenty hours of contact with 50 μc of labelled cytidine buds were removed from the inflorescences and the anthers excised and cultured. The medium contained minerals, vitamins, 4% sucrose, 100 ppm glutamic acid and agar. Microsporocytes were in premeiotic through zygotene stages of reduction division when the anthers were excised.

Autoradiographs revealed that at zero time of culturing labelled DNA was present only in the pre-leptotene microsporocytes. After several days of culturing labelled DNA was detected in anthers which contained microsporocytes in pre-meiosis at zero time. A pool of soluble precursor substances probably provided the necessary metabolites for this delayed labelling of DNA.

Zero time observations revealed that very little labelled RNA was incorporated into the cytoplasm as sporogenous cells progressed from leptotene to zygotene. In general, it was found that isotopic substances were maintained longer in pre-meiotic, pre-leptotene and early leptotene microsporocytes than in the more mature anther material.

Labelled DNA was detected in some tapetal nuclei of the pre-meiotic material at zero time, while all tapetal nuclei were well labelled in anthers containing sporogenous cells in zygotene. All anthers revealed labelled RNA in tapetum at the start of culturing. Since breakdown of the tapetum occurs in vitro, decreased amounts of labelled nucleic acid became evident as the anthers progressed in culture. When complete breakdown of tapetal tissue occurred, labelled nucleic acids were no longer detected.

Feulgen positive globules, which were found in association with microsporocyte nuclei, were not involved in any transfer of isotopic substances from one tissue to another.

Microfilm $2.00; Xerox $4.80. 91 pages.

A TAXONOMIC REVISION OF ASIMINA AND DEERINGOTHAMNUS IN NORTH AMERICA NORTH OF MEXICO

(L. C. Card No. Mic 59-1759)

Robert Kral, Ph.D.
The Florida State University, 1959

This paper was prompted by the confused nomenclatural bases of the North American genera Asimina and Deeringothamnus (Annonaceae), which comprise ten species and one geographical variant. All of the species are restricted in their distribution to North America north of Mexico. Revision of the former genus was to involve a resolution of species; that of the latter genus a verification of the genus itself. Several species of Asimina had been observed by William Bartram during his travels through Florida and south Georgia during the latter half of the eighteenth century. Bartram's descriptions of four of the species, whether by text or illustration, were largely accurate, yet the interpretations of Bartram's work by subsequent authors are varied. Solution of this part of the problem appeared to lie in a critical field evaluation of the gross morphology and habitat requirements of the individual species, coupled with a reappraisal of synonymy, particularly in regard to Bartram names.

A review of the critical literature served to point out the following:

1. The genus Asimina, as typified by A. triloba (L.) Dunal, has been well established as a biological and nomenclatural unit.

2. All earlier investigators based much of their descriptive work on Asimina upon the observations, drawings, and specimens of Bartram. Any current work on that genus must therefore begin with a study of the travels, notes, specimens, and itineraries of Bartram.

3. By the present nomenclatural rules a good proportion of the specific spithets in the genus must be credited to Felix Dunal, who apparently had access to Bartram's specimens and drawings and who was the first to transfer the species (other than Asimina triloba) to their correct genus.

4. With the exception of the work of Bartram, Nash, and Small, most of the work on Asimina was done by herbarium botanists. Considerable field study was essential to a significant contribution on the biology of Asimina species.

As an aid to the study a total of 2466 herbarium specimens was borrowed from 19 herbaria. Photographs of Bartram types were requested and received from the British Museum in London. Field work on the two genera extended over a period of three years, during which time nearly all the Florida counties north of the Lake Okeechobee region were explored for Asimina and Deeringothamnus. Known type localities were revisited.

The revision includes artificial keys to taxa of Asimina and Deeringothamnus, these followed by the synonymy of each taxon, systematic treatment, and citations of specimens. Drawings of each taxon, executed from living material, are included in the text. One variety and one interspecific hybrid of Asimina are described as new to science. Other instances of hybridity are described in which the progeny are less consistent.

It is the opinion of the author that the controversial genus Deeringothamnus is indeed distinct and that the two species which comprise it should not be considered a part of the genus Asimina. A revision of the nomenclature of both genera has involved changes in the names of six entities in accord with the present Rules of Botanical Nomenclature. The study reveals the highly plastic nature of those sympatric Asimina species which, with breakdown of formerly effective ecological barriers through man-caused disturbance, are now hybridizing upon the altered habitats. It is suggested that further work with Asimina should entail growing the plants from selected seed, making experimental crosses and backcrosses, and determining more about the nature of those external isolating factors which have had a bearing on keeping such sympatric species distinct.

Microfilm $2.10; Xerox $7.40. 157 pages.

GROWTH IN VITRO OF GRAPE, ELM, WILLOW, POPLAR, AND OAK TISSUES ISOLATED FROM NORMAL STEMS AND INSECT GALLS

(L. C. Card No. Mic 59-2775)

Francis Jacques Pelet, Ph.D.
The University of Wisconsin, 1959

Supervisor: Associate Professor Albert C. Hildebrandt

The modifications of various plant tissues induced by gall-producing insects were investigated with plant tissue culture techniques which had been used successfully in the study of other abnormal and pathological growths. Experiments involved over 80,000 tissue transplants.

Physical environment influenced the growth of elm, willow, grape, and poplar tissues of normal and gall origins growing on synthetic media supplemented with coconut milk. Excised oak apple gall pieces failed to form any viable callus. Temperatures ranging from 16° to 36°C, tested at 4°C intervals, were all favorable for growth. The optimum varied from 28° to 36°C, firm tissues showing a high optimum. When the pH of the medium was adjusted to various levels over a range extending from pH 2.5 to pH 9.0, the best growth was observed between pH 6.0 and pH 7.5 if the medium contained 2,4-dichlorophenoxyacetic acid (2,4-D) and between pH 4.0 and pH 4.5 without this supplement. The individual strains of tissues generally were tested only on the medium on which they grew best. Growth was entirely inhibited below pH 3.0. In the alkaline range, some growth still occurred at the highest pH tested.

The chemical composition of the medium influenced the type of growth of the tissues. Friable tissues formed abundantly on basal medium supplemented with coconut milk (150 ml/l), α-naphthaleneacetic acid (NAA) (0.1 mg/l), and 2,4-D (6 mg/l). The presence of 2,4-D allowed the multiplication of loose parenchymatous cells. Tissues grown on coconut milk media could not be grafted successfully into their respective host plants. These results suggested that the tissues had been modified by cultivation.

The possibility of such a modification was investigated in a comparative study involving grape tissues excised from plants or cultured for one and four years on coconut milk media. Tissues of the following origins were compared: normal stems, leaf galls induced by Phylloxera vastatrix Planch., and occasionally normal leaf tissues. Vitamins, NAA, β-indoleacetic acid, kinetin, casein hydrolysate, yeast extract, a few nucleic acid bases and amino acids were tested at various concentrations and in combinations involving more than 400 media. Stem segments and pieces of gall tissues responded to all the chemicals tested. Callus formed from galls and normal leaves more readily than from stems with a medium containing kinetin. Stem segments responded to casein hydrolysate and thiamine more readily than the galls. Best growth occurred with 10 g/l of yeast extract with the stem and 1 g/l with the gall explants. Most of the differences could be attributed to different amounts of cambium or of assimilating parenchyma in stem and in gall explants. These differences disappeared after the tissues had been subcultured. A medium containing, besides agar, sugar, and minerals, the chemicals (mg/l) inositol (500), thiamine (1), calcium pantothenate (0.5),

pyridoxine (0.5), nicotinic acid (0.5), biotin (0.1), glycine (2), NAA (0.1), kinetin (1), adenine (40), and casein hydrolysate (3,000) gave a sustained growth comparable to the growth obtained with coconut milk media. The tissues maintained in culture four years were inhibited by casein hydrolysate and adenine. They also were inhibited with 1 mg/1 NAA, a concentration which had given best growth with freshly isolated tissues, and grew best with 0.01 mg/1 NAA.

The similar response of tissues of normal and insect gall origins suggested that the original stimulus to gall formation did not last. The action of the insect was investigated directly on tissues growing in vitro. Two or 3 aphids and about 20 eggs of phylloxera were transferred aseptically to each of 200 pieces of tissue. Fifteen colonies developed from eggs. The aphids lived and reproduced in captivity over periods ranging from 2 to 5 months. The aphids feeding on the tissues produced various modifications. Extracts of insects and eggs promoted growth of plant tissues when introduced into the basal medium.

Microfilm $2.00; Xerox $6.00. 123 pages.

LABORATORY STUDIES OF NITROGEN FIXATION UNDER CONDITIONS SIMULATING LAKE ENVIRONMENTS

(L. C. Card No. Mic 59-2780)

Richard Wilcox Tew, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Gerald C. Gerloff

Recent evidence indicates that nitrogen supply may be a limiting factor in the development of blooms of Microcystis aeruginosa in southern Wisconsin lakes. The contribution of nitrogen fixation to total supplies of nitrogen in these lakes therefore becomes of great interest.

In this investigation, some aspects of nitrogen fixation have been studied in laboratory experiments designed to simulate a variety of lake environments. The results are summarized as follows:

Nitrogen fixed by Azotobacter agile was very readily utilized for growth by Microcystis aeruginosa if suitable representatives of common and numerous species of ammonifying bacteria were also present. There was evidence that the algae contributed to favorable conditions for this rapid exchange of fixed nitrogen in the association experiments. Microcystis was unable to furnish sufficient substrate for detectable nitrogen fixation by Azotobacter, and a symbiotic relationship between these organisms appears to be non-existent.

Addition of fixed nitrogen to lake water cultures by indigenous blue-green algae was stimulated by addition of phosphorus and iron or sewage effluent. This indicates that fertilization of the natural environment with phosphorus and iron might result in considerable nitrogen fixation and thus indirectly might increase non-nitrogen-fixing phytoplankton for which nitrogen supply was limiting growth.

Large increases in fixed nitrogen were observed in illuminated and non-illuminated anaerobic enrichment cultures containing cellulose as substrate and sufficient bottom sediment to provide a representative inoculum and at least minimum supplies of growth factors and mineral nutrients. The bacterial community in these cultures included diverse and unusual forms. Phosphorous appeared to be the major element most likely to limit nitrogen fixation in sediments from Lake Mendota.

Substrates included in decomposing phytoplankton or higher plants may be separated from accompanying organic nitrogen at the lake sediment-hypolimnion boundary and may be utilized for anaerobic nitrogen fixation if ammonification is rapid and extensive, and if the initial proportion of ammonifiable organic nitrogen to substrate is not large. These conclusions were drawn from experiments employing an enrichment culture procedure modified to exploit the advantageous relationship of the rapid rate of ammonification of organic nitrogen and the slow rate of decomposition of complex polysaccharides.

Studies of the rate of decomposition of naturally occurring and laboratory cultured algae during sedimentation in an apparatus constructed to simulate conditions in a stratified lake indicate that separation of phytoplankton nitrogen and difficulty decomposed polysaccharides may be effected in epilimnia if sedimentation of the dead or dying algae is delayed until extensive ammonification has taken place.

Generally, the results indicate that for any location in a lake such as Mendota a variety of nitrogen-fixing organisms are present and capable of fixing nitrogen if substrate is available, if fixed nitrogen is either low in concentration in the growth medium or otherwise unavailable (i.e. incorporated into living cells), and if sufficient mineral elements are present.

Microfilm $2.00; Xerox $5.60. 112 pages.

AN ECOLOGICAL INVESTIGATION OF TWO DESERT SPECIES OF NICOTIANA

(L. C. Card No. Mic 59-2389)

Philip Vincent Wells, Ph.D.
Duke University, 1959

Supervisor: W. D. Billings

An ecological investigation was made of two species of the genus Nicotiana indigenous to the arid portions of western North America, N. attenuata Torrey and N. trigonophylla Dunal.

Field studies were made at 71 stations covering most of their range in the United States. These included observations on physiography and surrounding vegetation, soil sampling, and collection of specimens of tobaccos and associated insects. In addition, measurements were made of relative turgidity of the leaves of both species in relation to environmental conditions in southwestern Utah, throughout the summer of 1957.

The field studies were supplemented by taxonomic and

physiological investigations, conducted in the greenhouse and laboratory at Duke University.

Nicotiana attenuata is primarily a cold desert species, being found chiefly in the Great Basin, while N. trigonophylla is restricted to the warm or subtropical deserts of the Southwest. Evidence from field and greenhouse studies indicates that the taxon N. palmeri Gray is best interpreted as N. trigonophylla Dun. var. palmeri (Gray) Jones.

The habitats of the two species may be grouped under three categories: bedrock outcrops and talus, beds of intermittent watercourses, and ruderal sites. N. trigonophylla is most frequent in the first two, while N. attenuata is most frequent in the last.

These habitats have two things in common. First, they are all subject to continued disturbance due to the agency of erosion or man, and are therefore kept in a pioneer state, successionally speaking. Secondly, they are all periodically favored in regard to the water factor, whether due to the watershed effects of rocks, road surfaces, etc., or to the sporadic floods in the dry wash habitat.

The two species occurred on soils with similar properties. The soils were coarse in texture, circumneutral in pH and mostly non-saline.

Neither species is ordinarily associated with undisturbed vegetation. Rather, they occur enclave-wise on various disturbed, open sites. N. attenuata occurs in a wider range of vegetation types than N. trigonophylla, which is largely restricted to the more xeric types. The modal occurrence class for the former is northern or cold desert shrub, and for the latter, southern or warm desert shrub.

Light was found to be required for seed germination of both species. The red end of the spectrum was most effective, and the blue end least, in promoting germination. Since it was found that the transmission of light by the seed coats was seven times greater in the red end of the spectrum than in the blue, this may account for the greater effectiveness of red light.

Transmission spectra of sand and of a clay suspension showed that light of longer wavelength would penetrate the soil deepest.

The light requirement insures germination near the surface, which is of survival value because of the small food reserve associated with the minute size of the seeds. On the other hand, the red light sensitivity permits the seeds to germinate in the more favorable environment at the maximum depth of penetration by visible light, since red light penetrates deepest.

In summary, Nicotiana attenuata and N. trigonophylla are pioneer plants of the desert, but not true xerophytes. They inhabit disturbed soils of coarse texture, situated in physiographic niches periodically favored with respect to the water factor, but free of dense vegetation. They are excellently adapted to the rapid invasion of such pioneer sites by virtue of the mobility conferred on them by an enormous production of very minute seeds.

Microfilm $2.00; Xerox $6.20. 128 pages.

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CHEMISTRY, ANALYTICAL

A PROCEDURE FOR THE DETERMINATION OF ARSENIC, GOLD, AND COBALT IN BIOLOGICAL TISSUES.

(L. C. Card No. Mic 59-2554)

Bettie McSpedden Dale, Ph.D.
The Ohio State University, 1954

INTRODUCTION

One of the more recent developments in analytical techniques is the determination of trace amounts by radioactivation analysis. A specimen is bombarded with neutrons or charged particles, and the concentration of the elements of interest is determined by measuring the radioactivity induced in them. This technique is well suited to the measurement of trace elements in animal tissues, a problem which is at present of much interest in the field of biology.

Procedures have been developed in the present research for measuring the amount of gold, arsenic, and cobalt in ashed animal tissues. Tissue samples from rats and mice bearing transplanted tumors were analyzed for these elements by this method.

EXPERIMENTAL PROCEDURE

Ashing.—Weighed tissue samples (1 to 3 g.) were wet-ashed in Vycor Erlenmeyer flasks by heating on a hot-plate during treatment with 40 ml. of nitric acid. The acid was added in portions of 10 ml., and the samples were boiled to near dryness between additions. The residue was dissolved in 10 ml. of 3 N nitric acid; the volume was reduced to 1 ml., and a drop of concentrated hydrochloric acid was added. The solution was evaporated onto an aluminum boat approximately 2 cm. long. The boat was made by folding thin aluminum foil. The boats were wrapped with more foil and were rolled together forming a pellet 2 cm. long and 0.5 cm. in diam. These pellets were placed in aluminum irradiation cans along with duplicate standards of arsenic, gold, and cobalt. The standards were weighed on a microbalance in the form of gold tubing, cobalt wire, and arsenious oxide.

The samples were irradiated for one week in the nuclear reactor at the Oak Ridge National Laboratory.

Gold separation.—After the irradiation, the aluminum pellets were dissolved in 10 ml. of aqua regia. Gold chloride carrier (5 mg.) was added and the solution transferred to a 125 ml. separatory funnel. The volume of the solution was made to 20 ml. with water, and 20 ml. of ethyl acetate were added. The mixture was shaken for 30 seconds; it was allowed to stand for 10 minutes, and the aqueous phase was removed. Ten ml. of 6 N hydrochloric acid were added to the separatory funnel; the mixture was shaken for 30 seconds, and it was allowed to stand for 5 minutes. The aqueous phase was again drawn off and added to that removed previously. The washing with 10 ml. of 6 N hydrochloric acid was repeated in the same manner. The ethyl acetate layer was then placed in a 50 ml. beaker; the separatory funnel was rinsed with an additional portion of ethyl acetate which was added to the beaker. The beaker was placed under an infrared heat lamp and the solvent evaporated. The residue was dissolved in 0.5 ml. of aqua regia with slight warming. Ten ml. of 1 N sodium hydroxide were added, and the solution was transferred to an electrolysis cell. The volume of the liquid was made to 20 ml. with water, and 2 ml. of 5 per cent potassium cyanide in 0.1 N sodium hydroxide were added. The solution was electrolyzed for 1 hour at a current density of 10 milliamps. per sq. cm. An additional 2 ml. of potassium cyanide solution were added and the electrolysis was continued for two hours.

The gold was plated onto a copper disc 2.5 cm. in diameter. The electrolysis cell was dismantled; the disc was washed first with water and then with acetone; then it was dried. The activity of the discs was measured using a Geiger-Müller Tube with a 2.2 mg. mica/cm^2 window.

In every case the activity was followed through several half-lives in order to verify the nature of the separated activity and check for the presence of radioactive impurities.

The standards were processed in a similar manner. After evaporation of the ethyl acetate, the residue was diluted and an aliquot taken.

Arsenic Separation.—Arsenious acid carrier (10 mg. arsenic) and a crystal of ammonium iodide were added to the aqueous phase from the gold extraction. Hydrogen sulfide was passed into the solution, and the precipitate was allowed to settle for one hour or more. The solution was filtered using a Selas porcelain filter crucible. The precipitate was dissolved in 1-2 ml. of concentrated ammonium hydroxide and the solution was transferred to a distilling flask. The distilling apparatus was equipped with ground glass joints and contained a water-cooled condenser and an ice-water cooled receiver. A slow stream of hydrogen chloride was passed through the system throughout the distillation. Five ml. of saturated solution of cuprous chloride solution in hydrochloric acid were added to the distilling flask, and 10 ml. of concentrated hydrochloric acid were placed in the receiver. Fifteen ml. were distilled; 5 ml. of cuprous chloride solution were added to the pot and the distillation was continued until a total of 20 ml. had distilled. Hydrogen sulfide was passed into the distillate and the precipitate was allowed to stand for one hour or more. As before, the arsenious sulfide was filtered off with the use of a Selas filter crucible. The precipitate was dissolved in ammonium hydroxide and the solution and washings were transferred to the distilling flask. The process was then repeated exactly as described above. The arsenic in the distillate was precipitated as the sulfide. This was filtered using a Selas filter crucible. The sides of the crucible were washed down carefully; the precipitate was washed with small portions of ethyl alcohol and then with ether. The activity was measured in the filter crucibles using a Geiger-Müller tube; the measurements were made for several half-lives.

Cobalt Separation.—The filtrate of 40-50 ml. from the

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separation of arsenic sulfide was stored for several months.

Cobalt carrier (1.1 mg.) was added to the solutions, which were slowly evaporated to dryness; the residue was treated with 5 ml. of aqua regia and taken to dryness. The nitrate ion was destroyed by treatment with three portions of 10 ml. each of hydrochloric acid. The residue was then dissolved in 20 ml. of water; a small portion of hydrochloric acid was added since it was needed to complete the dissolution. Sodium hydroxide was added to a pH of 10 as measured by indicator paper. During this treatment aluminum hydroxide precipitated and completely redissolved. Hydrogen sulfide was passed into the solution precipitating cobalt sulfide, which was filtered off with the use of a Selas filter crucible. The precipitate was redissolved in 1-2 ml. of aqua regia. This solution was boiled to dryness and was treated with three portions of 5 ml. of hydrochloric acid. The residue was dissolved in 20 ml. of water, and the pH was adjusted to 6 with the use of ammonium hydroxide; 10 ml. of a saturated alcoholic solution of 1-nitroso-2 naphthol was added. The precipitate was allowed to stand about four hours and was filtered through a Selas filter crucible. The walls of the crucible were washed with water; the precipitate was dried in air. The activity of the cobalt was measured on a Geiger-Müller tube. The beta-rays were characterized by absorption in aluminum; the gamma spectrum was measured on a scintillation spectrometer.

The standards were diluted to 25 or 50 ml. and one ml. aliquots were taken. These were handled in the same manner as the tissue samples.

TABLE I

TISSUE ANALYSES

Sample	Weight (g.)	Weight Arsenic per g. wet tissue (micrograms)	Weight Gold per g. wet tissue (micrograms)	Weight Cobalt per g. wet tissue (micrograms)
Rat A				
spleen	1.91	1.56	0.101	1.95
lymph nodes	0.0316	1.45	0.161	1.19
tumor	3.88	2.60	0.199	1.19
Rat B				
spleen (normal animal)	0.904	-	0.101	1.57
tumor	2.999	-	0.026	0.093
spleen (tumor bearing animal)	1.900	-	0.135	1.19
C3H Mice				
spleen	0.789	-	0.467	-
tumor	0.646	-	0.184	-
blood	0.998	-	0.214	-
ABC Mice A				
spleen	0.845	0.40	0.461	<0.001
tumor	1.107	-	0.177	-
blood	1.131	3.43	0.202	-
ABC Mice B				
spleen	0.663	-	-	<0.001
tumor	1.023	-	0.0717	<0.001
blood	0.823	-	0.808	<0.001
CFW Mice				
spleen	0.865	-	0.0113	<0.001
tumor	0.508	-	0.0183	<0.001
blood	1.001	0.319	-	<0.001

TISSUE ANALYSES

The analytical scheme developed here was applied to tissue samples taken from experimental animals.

Rats of C. F. Wistar strain bearing transplanted lymphosarcoma, mice of C3H strain bearing transplanted C3HBA tumors, ABC strain mice bearing transplanted 15091a tumors, and CFW strain mice bearing transplanted sarcoma 37 were used.

Seven bombardments of 6 or 7 samples each were analyzed. The results of these analyses are shown in Table I. The spleen and lymph nodes of Rat A were taken from an animal bearing a tumor. All samples of mice tissue were from tumor-bearing animals. The arsenic standards bombarded with Rat B tissue decayed completely before the separation was completed. Other arsenic samples marked with a dash were too small to measure.

Tissue samples for ABC-A and C3H mice were dissected at the same time. ABC-B and CFW mice samples were also dissected at the same time.

SUMMARY

A procedure for determining the gold, arsenic, and cobalt content of biological tissue samples has been devised. The method was applied to rat and mice tissues and a comparison between cancerous and normal tissue was made.

The procedure used activation analysis. The material being analyzed was irradiated with neutrons in the nuclear reactor at the Oak Ridge National Laboratory; the activities formed belonging to gold, arsenic, and cobalt were isolated and measured. The quantities were calculated by comparison of the counting rates of the separated activities to the counting rates of standards of the elements which were irradiated at the same time.

The gold activity was separated from the tissue ash by extraction of an acid solution with ethyl acetate. The metal was then plated from a basic cyanide solution and the activity measured. Half-life measurements served to identify the activity as belonging to gold-198 and to check for radioactive contamination. The error of the method in determining known quantities of gold was 9.7 per cent or less.

The arsenic activity was separated from the tissue ash by precipitating as the sulfide. The precipitate was purified by distilling arsenic trichloride. Half-life measurements were used to identify the activity and to check for contamination. The accuracy of the method in determining known quantities of arsenic was 12.3 per cent or less.

The cobalt activity was separated from the tissue ash by precipitating in a very basic solution as the sulfide. The sulfide precipitate was reprecipitated as the 1-nitroso-2-naphtholate which was mounted for counting. Absorption of the beta-rays in aluminum and the scintillation spectrum were used to identify the activity as belong to cobalt and to check for contamination. The error of the method in the determination of known quantities of cobalt was 5.1 per cent or less. Microfilm $2.00; Xerox $3.00. 59 pages.

Abstract published by special arrangement with The Ohio State University.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

CHEMISTRY, BIOLOGICAL

A STUDY ON THE DEGRADATION OF LABELED MYO-INOSITOL

(L. C. Card No. Mic 59-2762)

John Noel Aronson, Ph.D.
The University of Wisconsin, 1959

Supervisor: Associate Professor Laurens Anderson

An effort was made to develop a degradation procedure for labeled myo-inositol to aid research on inositol biosynthesis.

Several new compounds were prepared from myo-inosose-2, which was obtained by the Acetobacter suboxydans oxidation of inositol. These are: DL-1,2-diketo-myo-inositol phenylosotriazole, 4,5-diformyl-2-phenyl-2,1,3-triazole, myo-inosose-2 ethylene disulfone, and an alkali transformation product of the ethylene disulfone incompletely characterized as DL-ido-pyranohexodialdose mono-(ethylene disulfone). Although the racemic osotriazole could be degraded further by known methods, it was not useful for work with biosynthetic inositol since it was obtained in poor yield. Its racemic nature was also disadvantageous since some carbon atoms of the degradation products would represent two or more of the inositol carbon atoms. Alkaline degradation of the ethylene disulfone was too complex to be useful since it gave two racemic products in poor yields. The periodate oxidation of the ethylene disulfone unexpectedly yielded (50%) 1,3-dithiolane 1,1,3,3-tetroxide, presumably by hydrolysis of an intermediate dialdehyde derivative in a manner analogous to the haloform cleavage of methyl ketones. This reaction was utilized in a specific degradation procedure for isolating carbon 2 of inositol, as follows:

myo-inositol → myo-inosose-2 → myo-inosose-2 ethylene mercaptal → myo-inosose-2 ethylene disulfone → 1,3-dithiolane 1,1,3,3-tetroxide

When the procedure was applied to a synthetic sample of inositol-2-C^{14}, it was shown that randomization of the label had not taken place during the synthesis.

The fermentation of inositol by Aerobacter aerogenes, strain 1033, previously reported by B. Magasanik (J. Biol. Chem., 205 : 1019, 1953) was studied to see if it could be developed into a useful degradation procedure for labeled inositol. The production of carbon dioxide, ethanol, and lactic acid reported by Magasanik was confirmed, but attempts at scaling up the procedure were unsuccessful. A study of the fermentation of inositol-2-C^{14} by the above organism revealed a certain amount of randomization of the label, but the greater part of the radioactivity was localized in the alpha and/or beta carbons of the lactic acid. This indicated that the dissimilation of inositol most probably took place to some extent in an asymmetric manner.

Inositol-4,5-C^{14}, asymmetrically labeled, was synthesized (50 mg., 9,000 c.p.m./millimole at 10% geometry). The starting material was glucose-3,4-C^{14} isolated from the "glycogen" of Escherichia coli B grown in an atmosphere of $C^{14}O_2$. This C^{14}-inositol was prepared to aid the study of the Aerobacter aerogenes fermentation, but could not be used since favorable conditions for the dissimilation of inositol were not found.

Microfilm $2.00; Xerox $4.00. 72 pages.

THE PHYSIOLOGICAL ROLE AND MECHANISM OF ACTION OF NITRATE REDUCTASE FROM RHIZOBIUM JAPONICUM

(L. C. Card No. Mic 59-2512)

George Maurice Cheniae, Ph.D.
North Carolina State College, 1959

Supervisor: Harold J. Evans

It was found that succinate-nitrate reductase of nodules was distributed widely in legumes. A close positive statistical correlation between nitrate reductase activity and N_2-fixing efficiency of strains of R. japonicum was shown. With certain legumes it was found that the activity of succinate-nitrate reductase increased with age of plant, reached an optimum, then decreased in a manner that paralleled changes in hemoglobin content of the nodules. With velvet bean virtually no activity could be detected at the time when nodules had become senescent. Addition of nitrate or ammonia to soybean plants decreased nitrate reductase activity of bacilli from nodules. Consistent decreased in hemoglobin content of nodules was observed with application of nitrate, but not ammonia, to soybean plants. Iron, but not molybdenum, deficiencies on N_2-cultured soybean plants reduced the activity of succinate-nitrate reductase. These results were discussed on the basis that some metabolic product, formed only while N_2 was being fixed, caused an adaptive formation of nitrate reductase. It was considered also that the enzyme was constitutive but was influenced by environmental factor(s) of the nodule.

A particulate nitrate reductase was isolated from bacilli of soybean nodules, and some properties of the enzyme-complex were determined. Succinate, reduced-methylene blue, reduced-benzylviologen and DPNH, but not TPNH, hypoxanthine, formate, ascorbate and p-phenylenediamine, were shown to donate electrons for nitrate reduction. The succinate-nitrate reductase exhibited many properties, including K_m value for succinate and K_i value for malonate, that were similar to classical succinoxidase.

From inhibition studies with sulfhydryl-binding agents it was concluded that sulfhydryl groups are essential for nitrate reduction with DPNH and succinate but not with reduced-benzylviologen. Inhibition studies with metal-chelating agents indicated that a metal was required for immediate transfer of electrons from nitrate reductase to nitrate. With reduced-benzylviologen as electron donor nitrate reductase was inhibited by cyanide, cyanate and azide but not by other chelating agents that inhibited activity with DPNH and succinate.

Kinetic studies on an irreversible inactivation by cyanide of DPNH- and succinate-nitrate reductase suggested an instantaneous inactivation at one site(s) in addition to inactivation at another site(s) that followed first order kinetics. These results suggested that two or more different

metal-sites were involved in transfer of electrons from these donors to nitrate.

Dicumarol and dinitrophenol inhibited the nitrate reductase activity with either DPNH or succinate as electron donors. No inhibition by dicumarol was observed when reduced-benzylviologen was used as a source of electrons. From inhibition studies with Antimycin A it was concluded that a cytochrome b was involved in electron transfer from DPNH or succinate to nitrate.

A phosphate (or arsenate) requirement was shown for succinate-nitrate reductase, and a non-specific electrolyte requirement was demonstrated for DPNH-nitrate reductase. Phosphate or arsenate caused a striking decrease in the absorbance of the particulate complex. Other electrolytes were without appreciable effect.

A factor, extractable by acetone from R. japonicum, was shown to be necessary for coupling oxidation of DPNH, but not succinate, to nitrate reduction. Menadione, but not Vitamin K_1 and α-tocopherol, would replace the extractable factor. Dicumarol inhibited the menadione activation in a competitive manner.

It was suggested that non-heme iron was involved in transfer of electrons from nitrate reductase per se to nitrate and that a cytochrome b mediated transfer of electrons from either DPNH or succinate to nitrate. It was concluded also that a Vitamin K was necessary for electron transfer from DPNH, but not succinate, to the cytochrome b.

The conclusion was made that the nitrate reductase was involved in "nitrate respiration" but was associated indirectly with N_2-fixation. Several hypotheses were advanced suggesting the manner in which nitrate reductase is associated with N_2-fixation.

Microfilm $2.00; Xerox $10.00. 121 pages.

INFLUENCE OF LYSOZYME ON EGG WHITE QUALITY

(L. C. Card No. Mic 59-2551)

Owen Jay Cotterill, Ph.D.
The Ohio State University, 1954

Egg white thinning has been used as an indicator of quality loss in shell eggs for many years. Several environmental and inherent factors have been shown to influence the rate and degree of thinning. Some of these factors have been investigated in great detail. Others have received only limited attention.

The mechanism or the nature of the changes taking place during the thinning of egg white has not been explained. The purpose of the present study was to obtain more information about the egg white thinning mechanism. It is presumed that a better understanding of these changes will assist in discovering new methods or improving upon current practices to retard the loss of quality resulting from egg white thinning.

At the present time, there are two theories of egg white thinning. One theory is based upon the observation by Hoover[1] that reducing compounds, such as hydrogen sulfide and thioglycol, induce changes in egg white which resemble the natural thinning process. This theory is supported by the observation of MacDonnell, et al.,[2] that if only 2 per cent of the sulfhydryl groups in ovalbumin become as active as the sulfhydryl of thioglycol, marked deterioration (thinning) of the white will take place.

A second theory of egg white thinning was advanced by Hawthorne.[3] He noted that lysozyme would interact with ovomucin and cause the two proteins to precipitate. He suggested that the thinning of the thick white gel which occurs during the storage of eggs may, in part, be due to the action of lysozyme on ovomucin. This observation furnished the background for the investigations reported in the dissertation.

The research problem as outlined and conducted included the following four related phases:

1. Relative lysozyme activity in fresh eggs having low and high interior quality.
2. The effect of thermostabilization on lysozyme activity.
3. Lysozyme-ovomucin interaction.
4. Influence of ammonia on egg white quality.

EXPERIMENTATION AND RESULTS

High and Low Quality Eggs

The lysozyme activity of blended egg white was analyzed according to the principles of a method outlined by Boasson.[4] This method of analysis is dependent upon the change in turbidity of a suspension of M. lysodeikticus cells resulting from the lytic action of lysozyme. Slight modifications in the technique were employed.

Five consecutive eggs from each of four birds were analyzed individually for lysozyme activity. In addition, several eggs from different strains of birds were analyzed. The results are shown in Table I. The lysozyme activity of eggs from different birds varied between 0.36 and 0.47 per cent of the liquid egg white. Composite samples of egg white from different strains of chickens ranged between 0.33 to 0.51 per cent lysozyme activity.

TABLE I

Lysozyme Activity of Eggs from Different Birds and Strains of Birds

Bird or Strain Number	Lysozyme activity of different	
	Birds (%)	Strains (%)
1	0.36	0.33
2	0.39	0.51
3	0.40	0.43
4	0.47	0.36

After establishing that the lysozyme activity of egg white varied between different individual birds and strains of birds, a total of 320 eggs were collected, one-half of which were high quality (above 85 Haugh units), the remaining of which were low quality (below 65 Haugh units). Each quality group was divided into four composite samples. The samples were maintained in a frozen state until analyzed for lysozyme activity. The average lysozyme activity of the high and low quality groups was the same.

Micro. A9-202 MH-42

Effect of Thermostabilization

Shell eggs were thermostabilized in water at different temperatures and times, and at different time intervals after production. The effects of these treatments on the lysozyme activity, white quality, turbidity, and pH of the white were determined. The results are shown in Table II.

Table II

The Effect of Shell Egg Thermostabilization Temperature for 15 Minutes on Egg White Quality, Lysozyme Activity and Turbidity

Treatments	Haugh units	Lysozyme Activity (%)	Turbidity (E^*)
Control	68	0.44	.066
130°F	76	0.46	.090
132°F	77	0.45	.091
134°F	77	0.41	.095
136°F	79	0.39	.133
138°F	82	0.32	.212

*Extinction coefficient.

Thermostabilization at 130°F for 15 minutes did not destroy any lysozyme activity, but did increase the white quality (as measured by Haugh units) and the turbidity, slightly. Temperatures above 134°F for 15 minutes dstroyed some lysozyme activity. Additional research demonstrated that the pH level may be instrumental in the destruction of egg white lysozyme when shell eggs are thermostabilized at 136°F for 15 minutes. More lysozyme was destroyed in seven-day-old eggs (pH 9.0) than in one-day-old eggs (pH 8.5). Higher thermostabilization temperatures for shorter exposure times were very destructive to lysozyme activity in egg white.

Lysozyme-Ovomucin Interaction

The in vitro effects of pH, heat, ionic strength (preliminary observations only), and sulfhydryl groups on the manner in which thick white and/or ovomucin interacts with an excess of lysozyme were investigated. The different pH levels were obtained by using buffers. The effects of heat were observed by "thermostabilizing" the preparations in centrifuge tubes in a constant temperature water bath. The effects of increasing the ionic strength of 0.1 N with respect to NaCl were noted. Thioglycol at 100 p.p.m. was used to furnish the sulfhydryl groups.

The effects of increasing the pH on the amount of nitrogen precipitated by the lysozyme-thick white and/or ovomucin interaction are shown in Table III. Less nitrogen was precipitated as the pH approached the isoelectric point of lysozyme (pH 10 - 11). Likewise, adding sulfhydryl groups and increasing the ionic strength decreased the intensity of this protein interaction.

The effects of heating the egg white and crude ovomucin at pH 8.4 prior to adding the lysozyme are shown in Table IV. Thermostabilization increased the amount of nitrogen precipitated by the lysozyme from thick white but had no affect on the crude ovomucin-lysozyme interaction.

TABLE III

Influence of pH on the Amount of Nitrogen Precipitated by Adding Excess Lysozyme to Thick White and Crude Ovomucin

pH	Nitrogen precipitated from	
	Thick white (%)	Crude ovomucin (%)
7.2	5.5	42.0
8.0	4.9	41.7
8.8	3.3	41.3
9.6	2.4	30.1
10.4	1.6	25.1

TABLE IV

The Effect of Thermostabilization at pH 8.4 on the Amount of Nitrogen Precipitated by Adding Excess Lysozyme to Thick White and Crude Ovomucin

Treatments	Nitrogen precipitated from	
	Thick white (%)	Ovomucin (%)
Control	9.2	60.6
128°F—15 minutes	14.1	62.6
134°F—15 minutes	16.9	59.4

Effect of Ammonia on Egg White Quality

Fresh eggs (less than eight hours old) were exposed in desiccators to various levels of ammonia. The different levels of ammonia were obtained by placing six eggs in a desiccator containing: none, 0.05, 0.10, 0.25, 0.50, 1.00, and 2.00 ml. of ammonium hydroxide (28 per cent NH_3). After a 14-hour exposure to the ammonia at room temperature, the egg white quality; pH of white, yolk, and whole egg; and turbidity of the white were noted. The results are shown in Table V.

TABLE V

The Effects of Exposing Shell Eggs to an Atmosphere Containing Ammonia

Ammonium hydroxide added (cc.)	Haugh units	pH			Extinction coefficient of white
		Whole	White	Yolk	
0.00	84	7.3	8.5	6.2	.284
0.05	83	7.4	8.6	6.2	.260
0.10	83	7.6	8.7	6.3	.244
0.25	81	7.7	8.8	6.6	.201
0.50	79	8.2	8.9	7.0	.187
1.00	73	8.8	9.2	7.3	.194
2.00	62	9.3	9.5	8.3	.161

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Increasing the pH of egg white by exposing shell eggs to ammonia decreased the white quality (as shown by Haugh unit measurements). Likewise, the extinction coefficient (cloudiness) of the white decreased. As might be expected, the pH of the whole egg and yolk also increased.

SUMMARY

1. Consecutive eggs from the same hen vary less in lysozyme activity than eggs from different birds.

2. Differences in lysozyme activity were obtained in eggs from different strains of birds.

3. The calculation of lysozyme activity on the basis of total protein or total solids content of egg white did not eliminate the differences between strains.

4. High and low quality fresh eggs contained about the same amount of lysozyme activity.

5. Egg white preparations could be stored in the frozen state for several weeks without the lysozyme activity being affected.

6. Thermostabilization of fresh eggs at 130°F for 15 minutes in water did not affect the lysozyme activity; however, it did improve the egg white quality as measured by Haugh units. It also increased the turbidity slightly.

7. Thermostabilization in water at 134° to 138°F for 15 minutes destroyed some lysozyme activity and caused further increases in egg white quality and turbidity of the white. Some coagulation was apparent at 136°F and above.

8. Thermostabilization at 136°F for 15 minutes destroyed more lysozyme activity in seven-day-old eggs than in day-old eggs. The older eggs had the higher pH. This probably accounted for the greater destruction of lysozyme activity. Likewise, as shown by the change in turbidity, the egg white from the older eggs was more heat labile.

9. The use of higher thermostabilization temperatures for shorter exposure times was very destructive to lysozyme activity. Extensive coagulation occurred near the shell.

10. The beneficial effects of thermostabilization did not appear to be a result of lysozyme destruction.

11. Hawthorne's observation[3] that lysozyme will interact with ovomucin was confirmed.

12. By the use of a series of buffers between pH 7.2 and 10.4, it was observed that at the higher pH levels (near the isoelectric point of lysozyme) lysozyme and crude ovomucin would not interact to form the characteristic precipitate. This deviation in the interaction at the higher pH levels parallels the thinning of egg white resulting from an increase in pH after the loss of carbon dioxide.

13. Similar results were obtained when thick white was substituted for the crude ovomucin.

14. Heating the crude ovomucin preparation in centrifuge tubes under conditions which simulated thermostabilization did not affect the nature of the lysozyme-ovomucin interaction.

15. Heating the thick white prior to adding the excess lysozyme increased the amount of protein precipitated by lysozyme. The cause of this increased precipitation was not determined.

16. Increasing the ionic strength to 0.1 N with respect to added sodium chloride dissolved the precipitate.

17. The addition of sulfhydryl groups to thick white and the crude ovomucin preparation decreased the amount of a protein precipitated by lysozyme and produced a more compact precipitate than in the absence of sulfhydryl.

18. Sulfhydryl groups altered the manner in which the precipitate was formed. A more focculent precipitate was formed when thick white was treated with sulfhydryl groups. The normal precipitate was more flaky and stringy.

19. Increasing the pH of egg white by exposing shell eggs to ammonia enhanced the thinning of egg white and decreased the turbidity of the white.

20. The absorption of ammonia by the mixed whole egg and yolk, which were exposed to the higher concentrations of ammonia, increased the pH well above that point which is encountered during the normal aging process of shell eggs.

21. The ammonia taken up by the white did not raise the pH above that point which is normally obtained by the loss of carbon dioxide in storage.

22. The lysozyme-ovomucin interaction may be responsible for maintaining the thick white in a firm gel state, and the absence or decrease of this protein interaction may be responsible for egg white thinning.

Microfilm $2.00; Xerox $7.20. 152 pages.

1. Hoover, S. R. "A Physical and Chemical Study of Ovomucin." Doctoral dissertation, Georgetown University, 1940.

2. MacDonnell, L. R., Lineweaver, H., and Feeney, R. E. "Chemistry of Shell Egg Deterioration: Effect of Reducing Agents," Poultry Sci., 30 (1951), pp. 856-63.

3. Hawthorne, J. R. "The action of Egg White Lysozyme on Ovomucoid and Ovomucin," Biochim. et Biophy. Acta, 6 (1950), pp. 28-35.

4. Boasson, E. H. "On the Bacteriolysis by Lysozyme," J. Immunol., 34 (1938), pp. 281-93.

Abstract published by special arrangement with The Ohio State University.

RUMEN MICROBIAL NUCLEIC ACID AND PROTEIN METABOLISM

(L. C. Card No. Mic 59-2623)

William Clarence Ellis, Ph.D.
University of Missouri, 1959

Supervisor: Dr. William H. Pfander

A fractionation procedure was developed whereby nucleic acids, and the nitrogen of microbial protein, alcohol soluble protein, ammonia, urea and free amino acids, and the steam volatile fatty acids could be quantitatively determined on 10 ml. of rumen ingesta. Ribonucleic acid and deoxyribonucleic acid were separated on the basis of their solubility and insolubility in 2.5 per cent trichloroacetic acid, respectively. Individual nucleic acids were then determined on the basis of their phosphorus content which was demonstrated to check with independent nucleic acid determinations based either upon the pentose moiety or ultraviolet absorption.

These procedures were employed to study the in vitro relationship between rumen microbial protein and nucleic acid synthesis. Donor sheep were fed a low nitrogen basal ration supplemented with urea, urea plus purified amino acids, amino acids, zein, and zein plus urea. Rumen ingesta samples were removed, sub-samples placed in

anerobic incubation tubes and incubated. Individual incubation tubes were removed at selective time intervals, microbial action halted and the ingesta analyzed using the above fractionation procedures.

It was assumed that initially within a predetermined experimental error, each tube's contents was homologous; therefore, tubes removed after incubation would contain amounts of each constituent equal to that in the basal tube plus or minus the amount synthesized or degraded, respectively, for that increment of time. Time-concentration curves were then constructed for R.N.A. phosphorus, microbial protein nitrogen, and the other constituents determined.

A highly significant correlation ($r = +0.87$, $P = 0.01$) was found between increases in microbial protein nitrogen (Y, in mgm.) and increases in R.N.A. phosphorus (X_2, in mgm.) when time (X_3, in hours) was held constant. The partial regression equation for this relationship was $Y = 0.80 + 7.23X_2 + 0.11X_3$ with a standard error of 0.58 mgm. nitrogen. No correlation was observed to exist between D.N.A. phosphorus and microbial protein nitrogen.

It was concluded that increases in R.N.A. phosphorus could be used to estimate increases in mixed rumen microbial protein when similar in vitro conditions were maintained between different experiments. The standard error attached to such an estimate may be prohibitive when diluted rather than whole ingesta is employed.

Microfilm $2.25; Xerox $7.80. 169 pages.

SOME ASPECTS OF THE METABOLIC FUNCTION OF THE NATURALLY OCCURRING AMINES

(L. C. Card No. Mic 59-2795)

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University of Maryland, 1959

Supervisor: Dr. Edward J. Herbst

Hemophilus parainfluenzae requires one of several di- and polyamines that include the naturally occurring compounds, spermine, spermidine, putrescine and 1,3-propanediamine. Several other microorganisms either require or are stimulated by these amines.

The leakage of 260 mμ absorbing material from cells of microorganisms has been described in the literature. The appearance of 260 mμ absorbing substances from sonic extracts of H. parainfluenzae has been studied and characterized and it has been found that the 260 mμ substances are the fragments of RNA degradation. The optimum conditions for this reaction are as follows: temperature 37°C; pH 7.2; and ionic strength of 0.1-0.15. The reaction is enzymatic in nature and is apparently the result of ribonuclease activity. The reaction is inhibited by the inhibitors of ribonuclease as reported in the literature and has the same characteristics with the exception of the optimum pH.

Spermine is an inhibitor of this ribonucleic acid degradation in sonic extracts. The inhibition by other amines has been studied and is quantitatively less than that of spermine. Spermine also inhibits purified ribonuclease and deoxyribonuclease in vitro and evidence has been presented that the mechanism of this inhibition is by complexing with substrate and thus preventing enzyme activity.

Ribonucleic acid degradation has been studied in sonic extracts of a variety of other microorganisms. Quantitatively there is a larger or more rapid degradation in Gram-negative than in Gram-positive bacteria and spermine inhibits this degradation to some degree in all cases.

The effect of amines on induced enzyme synthesis has been studied using β-D-galactosidase and nitrate reductase. Spermine apparently has no effect on the induction process but does inhibit both of these enzymes. The effect of spermine on spermine on trypsin, yeast alcohol dehydrogenase, papain and a cobalt-activated pyrophosphatase has been studied for various reasons and it was found that it had no significant effect on any of them.

The effect of spermine on the formation and stability of nucleic acid formed in the presence of chloroamphenicol has been studied. Spermine stimulates the formation of this nucleic acid and inhibits its degradation to some extent, however, the significance of these results is unknown.

Evidence that amines are complexed with nucleic acid in vivo and in vitro has previously been reported. Additional evidence is presented as to the type and nature of this complexing. The bond is apparently of a salt-like nature and the amines may be equally bound to ribonucleic and deoxyribonucleic acid in bacterial sonic extracts. The effect of spermine on the absorption spectrum of the nucleic acids has been studied. Spermine decreases the absorption at 259 mμ and increases the minimum absorption and the point of minimum absorption shifts from 231 to 236 mμ with ribonucleic acid and from 232 to 238 mμ with deoxyribonucleic acid. There is a slight shift in the absorption maximum also. These results have been interpreted as evidence of spermine complexing with nucleic acid.

Microfilm $2.00; Xerox $3.60. 65 pages.

PART I. INHIBITION AND STIMULATION OF TOBACCO MOSAIC VIRUS BY PURINES. PART II. HEALTHY HOST ENZYMES FOR SCREENING ANTIVIRAL AGENTS.

(L. C. Card No. Mic 59-2771)

Ralph Harold Kurtzman, Jr., Ph.D.
The University of Wisconsin, 1959

Supervisors: Associate Professor A. C. Hildebrandt and Professor R. H. Burris

Part I.

The effects of fourteen purines upon multiplication of tobacco mosaic virus (TMV) and growth of host tissue cultures were studied in the first aspect of this investigation. One of these, 6-methylpurine, was also tested on whole plants. The tissue was that isolated by Morel from a crown gall on White Burley tobacco which was previously infected with TMV. Various concentrations of the purines were added to the medium prior to autoclaving. The effects of the purines on virus multiplication was measured by the local lesion assay after 1, 3 and 6 weeks incubation, and the effects on tissue culture growth were determined by weighing the tissue after 6 weeks incubation.

Three compounds, 6-chloropurine, purine, and 8-chloroxanthine, inhibited TMV about as well as 8-azaguanine and thiouracil. Concentrations from 10 to 100 mg./l were

required for virus inhibition, but the growth of the host tissue was inhibited at these levels.

2-Aminopurine 2,6,8-trichloropurine, caffeine, and isoguanine inhibited host tissue growth at a lower concentration than the virus multiplication. Theophylline, 6-mercaptopurine, and 2,6-di(diethylamino)purine had a comparable action. Caffeine showed a particularly strong stimulation of the virus at low concentrations; 1 g./1. enhanced virus production 80 percent in excess of the control. The concentration required for these compounds to inhibit tissues was generally 0.1 g./1. or more; however, 6-mercaptopurine and isoguanine each inhibited tissue at only 0.01 g./1.

Only hypoxanthine, 2-oxypurine, and 6-methyl-2-oxypurine had no apparent effect on either the virus or the host tissue.

6-Methylpurine was the first compound shown to inhibit virus without inhibiting the host. It had an antiviral activity at levels as low as 0.01 mg./1. and inhibited local lesions 40 percent at 0.1 mg./1. At least 0.25 mg./1. was necessary to damage the host tissue. If whole plants were used, 6-methylpurine had to be applied at 10 mg./1. to delay appearance of symptoms for seven days.

Part II.

In a second phase of the research, enzymes from healthy tobacco leaves were used for screening potential antiviral agents. Enzymes appeared potentially useful for screening since they are partially responsible for the specificity of an organism's response to various compounds. It had already been shown that some virus inhibitors are incorporated into the virus nucleic acid, so enzymes active in the initial incorporation of purine bases into nucleic acids (enzymes which form the ribosides of the purines) were investigated.

Two enzymes, inosine and guanosine phosphorylase, were purified about 1000 fold from crude extracts of tobacco leaves, and their general characteristics were studied. These enzymes were used in screening compounds for antiviral activity. Among sixteen compounds tested with tissue cultures or by other investigators and screened by this method, tissue culture tests placed four compounds outside the class predicted for them by the enzymatic tests. Three of these had less value than expected from the enzymatic appraisal, but one was a particularly active compound. The conclusions drawn must be considered tentative because they have not yet been tested sufficiently.

Thirteen other compounds were tested by the enzymatic method only. Eight of them would be expected to be either preferential virus inhibitors or inhibitory to both virus and tissue at the same concentration. The remaining five would be predicted to be preferential tissue inhibitors.

Microfilm $2.00; Xerox $3.80. 70 pages.

A BIOCHEMICAL STUDY OF THE COMPONENTS OF A LIPOPROTEIN-CARBOHYDRATE COMPLEX ISOLATED FROM BULL SPERMATOZOA

(L. C. Card No. Mic 59-2626)

Frank Madera-Orsini, Ph.D.
University of Missouri, 1959

Supervisor: Dr. Dennis T. Mayer

An alkaline-soluble, acid-precipitable fraction was isolated from bull spermatozoa which by electrophoretic studies was shown to be essentially a lipoprotein to which a number of other substances are strongly bound. The complex differs from the more soluble lipoproteins previously isolated from blood and other tissues. Qualitative and quantitative studies showed the presence of phospholipid, protein, cholesterol, glucosamine, glucuronic acid and calcium. The complex contained 13.8 per cent nitrogen, 0.81 per cent phosphorus and 30 per cent lipid materials. The lipid of the complex was comprised of 2.23 per cent cholesterol (1.71 per cent as free cholesterol and 0.53 per cent as esters), saturated and unsaturated fatty acids, neutral fats and phospholipids. Phosphatidyl serine, phosphatidyl ethanolamine, lecithin and acetal phospholipids were the phospholipids identified. The carbohydrates in the complex were glucose, galactose, glucosamine (0.60 per cent), n-acetyl glucosamine and glucuronic acid. The lipoprotein complex contained 7.65 per cent reducing substance calculated as glucose. The carbohydrates are possibly bound in the complex in the form of polysaccharides. The protein of the complex contained 14.6 per cent nitrogen, 0.5 per cent phosphorus, 1.73 per cent reducing substance and 0.69 per cent glucosamine.

The presence of sulphate, glucuronic acid and glucosamine in the complex suggested the presence of a heparin or heparin-like substance which was established by appropriate methods. A thromboplastic-like component with coagulating properties and calcium were also demonstrated. Thus, the three essential components of a clotting and anticlotting mechanism co-exist in bull spermatozoa. The possible relationship of this mechanism to the process of fertilization and subsequent cell division has been discussed. These results may also have applications in research on cellular biochemistry and, possibly, in certain phases of cancer research.

Microfilm $2.40; Xerox $8.40. 184 pages.

CHEMICAL QUANTITATION OF EPINEPHRINE AND NOREPINEPHRINE IN PLASMA (A CLINICAL AND EXPERIMENTAL STUDY).

(L. C. Card No. Mic 59-2374)

William Muir Manger, Ph.D.
University of Minnesota, 1959

By use of a modification of the fluorometric method of Weil-Malherbe and Bone, it has been possible to quantitate epinephrine and norepinephrine in plasma, cerebrospinal fluid and pheochromocytomas. This relatively simple chemical method seems highly sensitive, fairly specific, quite accurate and especially practical for quantitating the

plasma pressor amines. However, hemolysis, hyperbilirubinemia and certain drugs may interfere with quantitation or alter the concentration of plasma pressor amines.

We have convincingly demonstrated that determining the concentration of plasma pressor amines in patients suspected of having pheochromocytoma is of great diagnostic value. In the great majority of patients with clinical hypertension other than that associated with pheochromocytoma, the plasma concentration of pressor amines was not remarkably different from that in normal subjects. However, when the hypertension was due to pheochromocytoma, the plasma concentrations of epinephrine-like substance was invariably elevated. We have found some patients with renal insufficiency, lymphoma, or brain tumor have elevated values for plasma pressor amines. Mild to moderate stress in the human was occasionally accompanied by slight increases in the plasma pressor amines.

In experimental studies on the dog, hypertension resulting from increased intracranial pressure, electric stimulation of the splanchnic nerves, anoxia, or mechanical stimulation of the medulla oblongata or spinal cord was usually accompanied by considerable increase of plasma pressor amines. Hypertension resulting from carotid occlusion, exercise or bilateral nephrectomy was not consistently accompanied by increase of plasma pressor amines, whereas no increase was noted in dogs with hypertension caused by section of the buffer nerves of the carotid sinuses or by wrapping the kidneys in cellophane. The increase in plasma pressor amines which followed hemorrhagic or anaphylactic shock or large intravenous doses of histamine appeared related primarily to the hypotensive response.

The concentration of plasma pressor amines in psychotic patients was not remarkably different from normal subjects. However, oral administration of 400 mg. mescaline was followed by a significant increase in the mean plasma concentration of epinephrine-like substance in normal subjects but not in psychotic patients. Administration of LSD-25 (50 ug orally) or mecholyl (10 mg. intramuscularly) did not result in any remarkable or consistent changes in the plasma pressor amines in normal subjects or psychotic patients. Electroshock resulted in considerable elevations in the concentration of plasma epinephrine-like substance. We found no significant differences between the concentration of epinephrine-like substance in cerebrospinal fluid of psychotic patients and the concentration in those without psychosis. However, concentration in the cerebrospinal fluid was less than in the plasma, in both normal subjects and psychotic patients.

From studies in the dog, it appears that the rapid disappearance of epinephrine and norepinephrine from the plasma following intravenous injection may be due to diffusion, and metabolic breakdown in sites other than the plasma. The liver appeared to be especially active in removing the pressor amines from the plasma. We obtained evidence suggesting that epinephrine may be converted to norepinephrine in vivo.

Microfilm $6.40; Xerox $22.20. 502 pages.

THE DISTRIBUTION OF IPRONIAZID IN BODY FLUIDS AND TISSUES AFTER ORAL ADMINISTRATION AND A METHOD FOR ITS DETERMINATION

(L. C. Card No. Mic 59-2747)

Carl Edward Moyer, Ph.D.
The Ohio State University, 1959

After the introduction of Marsilid for the treatment of mentally depressed patients, toxicologists were occasionally asked to determine iproniazid in body fluids obtained from such patients. When a search of the literature failed to disclose an acceptable method for the estimation of iproniazid the present investigation was begun.

Attempts were made to develop a procedure for the determination of iproniazid in body fluids. Various colorimetric methods proposed for the determination of pyridine carboxylic acids and their derivatives were investigated. One of these methods was the reaction of the pyridinium group with cyanogen bromide followed by coupling with an amine which produced a colored product. Another method was the reaction of the pyridinium group with 2, 4-dinitrochlorobenzene to form a substituted pyridinium quaternary salt. The pyridine ring was cleaved by alkaline hydrolysis, and the addition of a dilute acid then produced the colored compound glutaconaldehyde. These procedures did not suggest a method that could be used for the determination of iproniazid in body fluids because of the low concentration of iproniazid present.

A spectrophotometric procedure for the determination of iproniazid was next proposed. At 265 to 270 mμ, isonicotinic acid and its derivatives produce a band of absorption which is not shown by nicotinic acid and its derivatives. By extracting from a basic solution with chloroform, iproniazid could be separated from isonicotinic acid and isonicotinamide. The resulting chloroform solution of iproniazid was then extracted with 5 ml. of 1 N hydrochloric acid. The absorbance of the solution resulting from the extraction could then be related to the concentration of iproniazid in the solution.

Since the amount of added iproniazid found in blood or urine was only 70 per cent of the theoretical amount present when aqueous standards were used, known amounts of the drug were added to serum or urine for use in standards, and these standards were treated in the same manner as unknowns.

The quantity of iproniazid in the blood of rabbits that had received the drug orally was determined and found to be small. The blood level reached its peak in about one or one and one-half hours after the administration, and the concentration amounted to approximately 5 per cent of the total dose.

The urinary excretion of iproniazid by the rabbit amounted to approximately 50 per cent of the total dose, and the drug could still be found in the urine five or six days after the administration was discontinued.

When the rate of absorption of iproniazid from the intestinal tract of the rat was studied, absorption was found to occur rather rapidly. Approximately 20 per cent of the dose was absorbed in thirty minutes, and in two hours after administration approximately 80 per cent had been absorbed.

The blood and urine concentrations of iproniazid of five mental patients who had been receiving 25 mg. Marsilid

phosphate tablets twice daily were determined. The blood concentration here ranged from 0.9 to 1.6 gamma per ml., and the urinary excretion varied from 0.9 to 1.6 mg. per 24 hours.

Approximately 18 per cent of the drug was found in the liver and kidneys of the rabbit.

Microfilm $2.00; Xerox $4.20. 78 pages.

A STUDY OF THE COMPARATIVE BIOCHEMISTRY OF SOME MARINE INVERTEBRATES

(L. C. Card No. Mic 59-2071)

Paul Holger Odense, Ph.D.
The University of Oklahoma, 1959

Major Professor: Leon S. Ciereszko

That part of comparative biochemistry which deals with the distribution of compounds among various animals and plants may be termed comparative morphology on a molecular level. It can be expected to provide new evidence to test present theories of taxonomy and evolution. To be useful, comparative biochemistry requires much data. The present study provides data for some members of the phylum Coelenterata, the gorgonians, which have received little attention in comparative studies.

Aqueous extracts of these animals contained guanidine bases. Creatine has seldom been found in such extracts from invertebrates, but in the present study creatine was found in nine of the seventeen species examined: Plexaura flexuosa, Plexaura homomalla, Plexaurella nutans, Plexaurella dichotoma, Pterogorgia acerosa, Pterogorgia americana, Rhipidogorgia flabellum, Eunicea mammosa and Plexaura flavida. Three species, Pterogorgia acerosa, Pterogorgia americana and Rhipidogorgia flabellum appeared to contain traces of glycocyamine, a precursor of creatine. No other guanidine bases were detected. If these gorgonians contain a phosphagen it must be creatine phosphate.

Arginine was found in one tunicate, Polycarpa obtecta, in the holothurians, Stichopus badionotus and Synaptula hydriformis, and the echinoid, Tripneustes esculentus. The absence of creatine in the tunicate was surprising since this compound has been found in two other species of tunicates.

A pigment was found in the siphon muscles of Polycarpa obtecta. The pigment was soluble in water but not in organic solvents. It acted as a pH indicator, turning green in alkaline solutions and red in neutral or slightly acid solutions. It behaved as an acid on ion exchange resins.

Seventeen species of gorgonians were extracted in Soxhlet extractors with pentane. The extracts were rich in oils, waxes and pigments, and in the case of Plexaura crassa, Eunicea mammosa, Xiphigorgia anceps and Briareum asbestinum crystalline precipitates were obtained during extraction. The colorless, crystalline compounds were purified by treatment with activated carbon and were recrystallized from methanol or ether. The compound from Eunicea mammosa, eunicin, M.P. 149 - 151°C. is optically active and unsaturated. The best-fitting empirical formula for eunicin is $C_{15}H_{22}O_3$. Its chemical behavior and infrared absorption spectrum indicate that it is a lactone. The compound from Xiphigorgia anceps, M.P. 91.5 - 92.0°C, has the empirical formula $C_{12}H_{18}O_2$ and appears to be an ester or diketone.

The carotenoid pigment mutatochrome, first found in orange peels, was found in the pentane extracts of Muricea muricata, Plexaura crassa, Plexaura esperi, Plexaurella nutans, Plexaurella dichotoma, Eunicea mammosa and Xiphigorgia anceps.

Antheraxanthin, a pigment first found in lilies, was found in the crystalline precipitate in the pentane extracts of Briareum asbestinum, Plexaura crassa and Eunicea mammosa.

A porphyrin compound, pheophytin a, was isolated from the pentane extracts of Eunicea mammosa, Plexaura flavida, Plexaura homomalla, Muricea muricata, Xiphigorgia anceps, Plexaura esperi, Plexaura crassa and Eunicea grandis. Microfilm $2.00; Xerox $4.60. 89 pages.

ISOLATED RAT LIVER PERFUSION STUDIES ON THE METABOLIC CHARACTERISTICS OF HYPERTHYROIDISM

(L. C. Card No. Mic 59-2591)

Alvin Sidney Ostashever, Ph.D.
Columbia University, 1959

A. A new rat liver perfusion apparatus is described, together with detailed discussion of isolated rat liver perfusion technique.

From considerations of four hour perfusion data on respiration, amino acid utilization, urea production, lactic acid clearance, glucose and fructose utilization, bile formation, and duplication of response to repeated amino acid and fructose doses, the isolated perfused rat liver displayed a viability unattainable by more conventional in vitro procedures.

B. The presently developed rat liver perfusion technique was applied to a study of the liver metabolic characteristics in hyperthyroidism, with the following results:

1. An in vitro respiration response to thyroxin or to 3, 5, 3' triiodothyronine could not be obtained during 4 and 6 hour perfusions. Therefore, experimental acute hyperthyroidism was induced by daily intraperitoneal thyroxin injections of 0.4 mg./100 gm. for 4 days.

2. With each of 4 different substrate additions consisting of amino acids and glucose, amino acids and fructose, U.C.^{14} glucose, and U.C.^{14} fructose, the perfused livers of hyperthyroid rats had markedly augmented respiration rates during 2.5 - 3.0 hour perfusions.

3. Fructose exerted a greater nitrogen sparing action on the hyperthyroid liver than glucose, as witnessed by lessened rates of perfusate amino nitrogen disappearance and urea nitrogen production.

4. In relation to the total liver oxidative metabolism, the perfused hyperthyroid rat liver showed a proportionally increased oxidation of U.C.^{14} fructose and a relatively diminished oxidation of U.C.^{14} glucose when compared to perfused control livers.

5. Low glycogen concentrations (0.08-0.88 gm./100 gm.) were invariably found in perfused livers from unfasted hyperthyroid rats. However, the high specific activity of this

glycogen after perfusions with U.C.^{14} glucose and U.C.^{14} fructose indicates that the effect is not primarily due to a diminished rate of glycogen synthesis, but rather to an accelerated glycogenolytic rate.

6. The perfused livers of hyperthyroid rats had elevated cholesterol concentrations, but not significantly different concentrations of total fatty acids or total protein.

7. The amounts of C^{14} activity derived from U.C.^{14} glucose and U.C.^{14} fructose found in the liver and perfusate total fatty acids, liver and perfusate total cholesterol, and the glutamic and aspartic acids of the liver and serum proteins, do not indicate that the augmented respiratory metabolism of the acutely hyperthyroid liver is either consistently or generally accompanied by a relative and absolute decrease of biosynthetic capability. The present results are, therefore, not in agreement with the hypothesis of an obligatory uncoupling of oxidative phosphorylation which has been advanced as the mechanism of action of the thyroid hormones.

C. High concentrations of free glucose were found in the perfused livers of control and hyperthyroid rats. Similar findings were made in the livers of fed and fasted rats, with values exceeding 1 gm./100 gm. being found several times in the former. Evaluation of in vivo and perfusion data indicates that these high concentrations of glucose may not be an artifact of post-mortem glycogenolysis, but rather that they may be normally present in the liver. The concept of a liver free glucose pool and its bearing on hepatic carbohydrate metabolism is discussed.

The free glucose concentrations of kidney and heart were found to be approximately at blood concentrations, while those of diaphragm and skeletal muscle were slightly lower. Brain contained very small concentrations of free glucose.

D. The barium precipitable salts of the fatty acids have been found to be a convenient means of quantitatively assaying C^{14} activity of liver fatty acids on filter paper.

A modified filtration unit for preparing mounts of radioactive precipitates on filter paper is also described.

Microfilm $2.45; Xerox $8.60. 187 pages.

MEASUREMENTS AND EFFECTS OF PROTEOLYSIS IN CHEESE UPON THE USE OF CHEESE IN PASTEURIZED PROCESS CHEESE SPREADS

(L. C. Card No. Mic 59-2782)

Demetrius George Vakaleris, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Walter V. Price

Measurements of proteolysis in cheese during ripening were developed and studied to determine what influence extent of proteolysis has upon the physical properties of cheese and pasteurized process cheese made from it.

Dariworld and Cheddar cheese of normal quality were manufactured from identical milk under experimentally controlled conditions. Special modifications were also used to produce lots of the same cheese with abnormally high pH. At selected intervals during 150 days of curing, portions of all lots were made into pasteurized process cheese spread.

The rate of proteolysis was measured by soluble nitrogen in a sodium citrate - hydrochloric acid extract of the cheese. The extract was buffered to a pH of 4.4 $\pm$ 0.05 and the measurements of soluble nitrogen were made by the Kjeldahl method and by formol titration (formol nitrogen). Dariworld and Cheddar of normal quality were not significantly different in rate or extent of proteolysis although Dariworld developed desirable body more quickly. Sweet modifications of both varieties were defective in quality but only the sweet Dariworld showed any difference (an increase) in rate of proteolysis.

Duration of ripening and formol nitrogen were linearly related by highly significant coefficients of correlation in both varieties of cheese. Soluble nitrogen (Kjeldahl) increased with age of cheese in a curvilinear manner; multiple correlation coefficients were highly significant statistically as were the curvilinear relationships between soluble nitrogen and formol nitrogen in both types of cheese. Estimation of cheese age by formol titration was not an exact procedure but was superior to the combined judgements of cheese experts using only sensory observations. Intensity of flavor was not closely correlated with either soluble nitrogen or formol nitrogen measurements.

Both Dariworld and Cheddar of normal quality improved for processing with increasing proteolysis. A minimum of one-eighth of the total protein in Dariworld and one-seventh in Cheddar had to be soluble in sodium citrate-hydrochloric acid extract at pH 4.4 $\pm$0.05 in order to produce pasteurized process cheese spread with minimum acceptable spreadability. These levels were reached by Dariworld in approximately 30 days and in Cheddar in 60 days. Maximum spreadability in spreads made from both varieties occurred when soluble protein approximated one-fifth of the total protein. Dariworld and Cheddar made with abnormally high pH produced spreads lacking in acceptable spreadability and melting properties regardless of their age at processing or the extent of proteolysis.

A rapid, direct method for estimating the degree of proteolysis in ripening cheese was studied by measuring absorption of ultraviolet light by a clear, sodium citrate-hydrochloric acid extract of cheese at pH 4.4 $\pm$ 0.05; these measurements were closely correlated with the per cent of soluble nitrogen in the cheese extract.

Measurements of the optical density of cheese from many sources and different ages revealed peaks of all absorption spectra between 274 and 275 mμ. The coefficient of correlation between optical density of the cheese extract and percentage of soluble nitrogen measured in the cheese extract by Kjeldahl was 0.958.

Concentrations of soluble tyrosine and soluble tryptophan were measured spectrophotometrically at optical densities of 270 and 290 mμ. Equations were developed by Vierordt's method of analysis of two component systems for this pair of wave lengths. Relationships between these compounds and percentage of soluble nitrogen in the cheese were linear and highly significant; the coefficient of correlation between soluble tyrosine and percentage of soluble nitrogen was 0.956, while that between soluble tryptophan and percentage of soluble nitrogen was 0.886.

Flavor intensity estimated in cheese of varied ages by professional judges showed a linear relationship to soluble tyrosine. Microfilm $2.80; Xerox $9.80. 216 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

THE ROLE OF C-21 STEROID HORMONES AS PRECURSORS IN THE BIOSYNTHESIS OF ANDROGENS BY THE HUMAN TESTIS

(L. C. Card No. Mic 59-2602)

Thomas A. Viscelli, Ph.D.
Columbia University, 1959

The androgens comprise a group of steroid hormones capable of maintaining the secondary sex characteristics of the male. The androgens have been isolated from various sources. However, our principle line of investigation concerned itself with the study of the biosynthetic mechanism of their production by the normal human testis. The two principle androgens thus far isolated from the human testis are testosterone and androstenedione. The problem then is to determine the nature of their precursors.

Earlier studies in other laboratories indicated that acetate could give rise to androgens through a pathway probably involving cholesterol. In addition, adrenocortical steroid hormones are also apparently synthesized by a mechanism involving cholesterol and ACTH. On administration of deuterocholesterol to a pregnant woman, Block was able to isolate deuteropregnanediol from her urine. With these three facts at hand it appeared probable that the androgens, which are C-19 steroids, arose from C-21 steroid metabolites of cholesterol.

A series of incubation studies were done with mince preparations of normal human testicular tissue obtained at surgery. Steroid hormones which were studied as probable precursors were the naturally occurring, physiologically active steroids; Δ^5-pregnenolone, progesterone, 17α-hydroxyprogesterone, cortisol, and corticosterone. One synthetic steroid, 17α-hydroxy-Δ^5-pregnenolone, was also studied in order to demonstrate enzyme specificity.

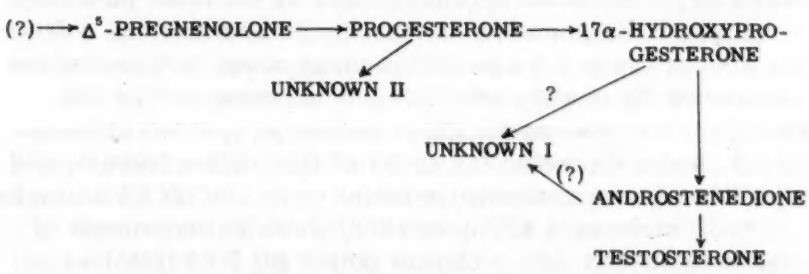
In the first series of experiments non-radioactive substrates were employed, each experiment being properly controlled. These experiments conclusively demonstrated that the testis could convert Δ^5-pregnenolone to progesterone and 17α-hydroxyprogesterone, and that the latter two steroids could give rise to androstenedione. Testosterone was indicated in one experiment where 17α-hydroxyprogesterone served as substrate, however, this was not conclusive. In addition to androstenedione, one as yet unknown C-19 steroid was separated from experiments with progesterone, and a second unknown C-19 steroid was separated from experiments with progesterone and 17α-hydroxyprogesterone. The testis demonstrated no activity towards cortisol, corticosterone, and 17α-hydroxy-Δ^5-pregnenolone.

On the basis of the results obtained with non-radioactive substrates, a second series of experiments were done using C^{14}-progesterone as substrate. The first experiment using this substrate was of a preliminary nature. All of the previously separated metabolites of this substrate were again separated and characterized without recourse to carrier addition. In addition, the specific activities of the metabolites were found to be such that they could unequivocally be designated as true metabolites of this substrate. It was desirable then to investigate the nature of sidechain cleavage of C-21 precursors which give rise to C-19 steroids.

Other investigators had demonstrated that the side chain was removed as a two carbon fragment. It appeared then that coenzyme A might be instrumental in the removal of the side chain since its role in acetate metabolism is well established. This cofactor was found not to have any direct effect on this mechanism although this did not eliminate its role as acceptor of the two carbon fragment.

Attempts were also made to characterize the unknown C-19 steroids which were also separated. Previously published reports indicated that one was a 17,20 glycol. Chromatographic, spectral, and chemical data obtained in our laboratory precluded the probability of such a steroid being formed during incubation. Our spectral data strongly indicate that this is a C-19 steroid. The second unknown steroid resembled two other physiologically active steroids, 11-deoxycorticosterone and epitestosterone. Again, chromatographic, spectral, and chemical data indicated that this unknown was a C-19 steroid, and neither of the two stated above.

On the basis of the foregoing results the following scheme is proposed in order to account for our experimental data:



Microfilm $2.00; Xerox $5.00. 99 pages.

THE EFFECT OF CASTRATION ON THE BIOCHEMISTRY AND QUALITY OF MEAT

(L. C. Card No. Mic 59-2726)

Eugene Wierbicki, Ph.D.
The Ohio State University, 1953

In the production of meat animals, castration of males is commonly practiced. Livestock producers have used this practice mainly for appraisal of live animals on the open market, which through longstanding custom pays higher prices for male animals so treated. However, very little critical study has been made of how castration effects the biochemistry or quality of meat from the consumer's point of view, or of the efficiency of feed utilization for producing more meat. This investigation was undertaken to study these questions. In this paper the first results are also presented concerning the effect of diethylstilbestrol upon the biochemistry and quality of beef. This synthetic estrogenic hormone when given to bulls counteracts some of the effects of the testicular hormones and thus brings about essential results comparable to castration without some of the disadvantage of the drastic operative procedure.

The investigation was conducted in a series of three yearly studies during the three years 1950-1953 in coöperation with the Department of Animal Science of the Ohio State Agricultural Experiment Station at Wooster, Ohio.

EXPERIMENTAL PROCEDURE

One hundred and fourteen Hereford cattle were examined from birth to the table, integrating the interests of the producer, the packer, and the consumer.

The animals, all of western origin - started as spring calves - were divided into seven groups representing seven different management practices: 22 steers castrated shortly after birth (I); 30 steers castrated at the age of 6-7 months (II); 5 steers castrated at the age of 9-10 months (III); 32 bulls fed for the entire experiment (IV); 10 bulls slaughtered at nearly the same market weights as steers (V); 10 bulls implanted subcutaneously with 25 mg./cwt. of diethylstilbestrol after feeding for 98 days as bulls (VI); and 5 bulls implanted with the same amount of the hormone at the start of the experiment and again after 98 days feeding (VII).

The animals were put on the test at the age of 6 to 7 months and held in the experiment from 182 to 252 days. These animals were dressed in the Meats Laboratory. The shortloins from the carcasses of these animals were used after 15 days aging at 38° F. for the evaluation of tenderness and juiciness on broiled steaks by the taste panel technique.[1] On some carcasses the determinations were run also at three days postmortem in order to observe the changes in the quality attributes of the meat during the storage. The determination of moisture, pH, intramuscular fat, hydroxyproline (an index of connective tissue), and myoglobin (as cyanometmyoglobin) were run on all animals.

On 48 carcasses (Project 1953) total N, the amount of total N extracted with a citrate buffer pH 5.60 (total ionic strength, 0.48, containing 0.22 M potassium chloride), were determined; and in the extracts from 24 of these animals specific gravity, relative viscosity, and refractive index were measured.

The biochemical factors were correlated with tenderness scores for the purpose of finding a biochemical basis for this quality in beef.

Reference has also been made to the weight gains and the physical composition of the carcasses in order to give a more complete picture of this entire project even though these data were gathered by others.

RESULTS AND CONCLUSIONS

The most important results of this investigation are summarized in Table I. The average values given therein are significant as indicated by the corresponding standard deviations. Study of the data obtained led to the following conclusions:

1. The bull calves (IV) gained significantly faster and utilized the feed more efficiently than the steers (I, II, III). Carcasses produced by the bulls showed slightly lower market grades. Owing largely to less waste (trimmed fat) the bull carcasses yielded a higher amount of edible meat than the steer carcasses.

The bull carcasses averaged 0.57 point less tender than those of the steers; the difference was not sufficiently large enough so as to detract from their value markedly. The biochemical studies revealed slightly higher amounts of hydroxyproline and significantly lower fat content.

2. The bulls slaughtered at light weights (V) were not superior to bulls fed for the prolonged period (IV), neither in weight gains nor in the quality of beef.

3. The steers castrated shortly after birth (I), or at the age of 6-7 months (II), gained practically at the same rate and produced carcasses of similar quality. The steers castrated at the age of 9-10 months (III) gained weight and produced carcasses of intermediate quality between the first two groups of steers and the bulls.

4. The diethylstilbestrol treated cattle (VI, VII) gained weight faster and utilized the feed still more efficiently than did the bulls (IV). The single implantation of the hormone (VI) influenced the development of the carcasses with a slightly lower market grade and with not quite the tenderness as of the bull beef (IV). However, the second implantation (VII) resulted in carcass qualities, both with respect to market grade and tenderness, similar to the steer beef (II, III). Simultaneously, the weight gains and feed utilization were increased in the case of the double implants over the single implants. These results may be of great importance in practical live stock production. The implantation of diethylstilbestrol lowered the amount of myoglobin in the beef. This effect seems to be in a direct relationship to the amount of the hormone implanted.

5. The tenderness scores and the biochemical factors revealed the following relationships:

There was a positive correlation between tenderness scores and fat, both at 3 (+0.557) and 15 (+0.325) days levels, when 114 cattle were considered as a group. Whether there is a direct relation between tenderness and intramuscular fat is still not settled since a bias is introduced by the known fact that a preponderance of female hormones causes fat deposition in muscle. The correlation of hydroxyproline with tenderness was not always equally high and significant. The r-values in the first series (1951) were very high, -0.645 at 3 days and -0.575 days postmortem, both significant for 28 degrees of freedom at the 1 per cent level. (At that time no correlation was found between the tenderness scores and marbling.) However, in the last two series of the investigation (1952-1953) this relationship was very poor and not significant, both at the 1 and 5 per cent levels. (The corresponding correlations with marbling were significant at that time.) For the entire project (114 samples) the hydroxyproline correlated significantly with tenderness only at 3 days level. The correlation obtained, -0.357, was relatively poor when considering the emphasis that has been placed on the connective tissue in relation to tenderness. An excellent positive correlation was obtained at 15 days level between tenderness scores and the percentage of total-N extracted (+0.507). A similar relationship was also found between the tenderness

TABLE I

THE EFFECT OF CASTRATION AND DIETHYLSTILBESTROL IMPLANTATION UPON THE WEIGHT GAINS, FEED UTILIZATION AND THE BIOCHEMISTRY AND QUALITY OF BEEF

Group Number[1]*	I Steers	II Steers		III Steers	IV Bulls		V Bulls	VI Single Implants	VII Double Implants
Year	1951, 1952	1951, 1952	1953	1953	1951, 1952	1953	1953	1953	1953
Number of cattle	22	22	8	5	22	10	10	10	5
Average daily gain, lb.[2]†	1.98	1.97	2.08	2.10	2.33	2.33	‡	2.52	2.68
Feed cost per cwt. gain, $	19.66	19.67	18.28	17.86	16.98	16.41	‡	15.40	14.53
Carcass grade,[2]† ***	1.14	1.30	1.33	1.82	2.53	2.01	2.47	2.09	1.64
Tenderness: 3 days****	6.88	6.47	--	--	5.32	--	--	--	--
15 days	7.84	7.69	8.00	7.58	7.20	7.45	7.09	6.77	7.72
Juiciness, 15 days**	4.21	4.19	4.50	4.64	4.28	4.43	3.79	4.26	3.73
Moisture, percent	71.42	71.69	71.86	73.64	73.77	73.66	74.30	73.50	74.01
Intramuscular fat, percent	5.59	5.45	3.76	2.33	2.51	2.23	1.91	2.35	1.93
Cyanometmyoglobin, percent***	0.436	0.437	0.363	0.343	0.426	0.378	0.332	0.351	0.276
Hydroxyproline, percent***	0.0432	0.0446	0.0339	0.0244	0.0494	0.0392	0.0269	0.0319	0.0192
Connective tissue, percent†, **‡†	0.349	0.360	0.274	0.197	0.391	0.316	0.217	0.257	0.155
pH: 3 days	5.56	5.60	--	--	5.54	--	--	--	--
15 days	5.67	5.70	5.63	5.48	5.73	5.60	5.58	5.54	5.38
% total-N extracted: 3 days	--	--	17.75*‡	--	--	18.54*‡	--	24.85*	--
15 days	--	--	29.20	27.22	--	25.29	23.98	25.25	29.04
N-concentration of the extracts (mg./ml.), 15 days	--	--	2.071	1.954	--	1.867	1.811	1.819	2.070
Tryptophan, percent***	0.329	0.330	--	--	0.330	--	--	--	--
Tyrosine, percent***	1.00	1.03	--	--	1.07	--	--	--	--

*[1]See explanation in text.

†[2]The data computed from the information furnished by Professors E. W. Klosterman, L. F. Kunkle, A. L. Moxon, and V. R. Cahill, the Ohio Agricultural Experiment Station and the Department of Animal Science, the Ohio State University.

‡[3]The results are similar to those of Group IV.

***Carcass grade factor: Prime - 0, 0.4, 0.7; Choice - 1, 1.4, 1.7; Good - 2, 2.4, 2.7; etc. .

****Tenderness scores: 10 - very tender; 1 - very tough.

**Juiciness scores: 5 - very tender; 1 - very dry.

***Wet Basis.

†[4]Connective tissue percent = Hydroxyproline percent x 8.07 (See Appendix).

‡[5]Average of 4, 5, and 5 samples respectively.

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and the refractive index of the extracts (+0.565). The correlation between tenderness and the relative viscosity of the extracts (+0.316) was rather poor, yet some evidence indicated that a closer relationship between the two factors may exist. These results give the first direct evidence that meat plasma is a major factor contributing to tenderness.

A very significant correlation between tenderness and carcass grade was also obtained, both at 3 and 15 days postmortem. This may be due to a bias in favor of steers over bulls because of established great standards for each class.

A significant positive correlation has been also found between the tenderness and juiciness scores.

No correlation was found between tenderness scores and cyanometmyoglobin or the specific gravity of the meat extracts. No relationship was observed between tenderness on the one hand and pH, moisture, and total-N on the other - thus confirming the reports of other authors.

There was an increase in tenderness during storage in all the cases which were investigated at 3 and 15 days postmortem. Also, pH, after an original drop, raised again with the postmortem age. Total-N extracted increased with the postmortem age - from approximately 18 per cent at 3 days to 25-30 per cent at 15 days postmortem.

The observations listed above led to the conclusion that there are in general three factors contributing to tenderness: the connective tissue, the intramuscular fat, and the meat plasma itself. The connective tissue and the fat are the static factors, directly responsible for tenderness or its opposite, the toughness in meat. The muscle plasma is a dynamic factor: the tenderness of a carcass depends upon the physicochemical state of its plasma constituents, mainly the contractile proteins. All three factors may not always correlate significantly with tenderness scores at the same time, as has been affirmed during the investigation. When one of the factors contributes relatively very much to tenderness, the effect of the remaining factors can not always be detected. In this situation inherent errors of individual tenderness determinations tend to approach the order of magnitude of the differences in tenderness observed.

6. An inquiry has also been made into the nature of the resolution of the rigor mortis in relation to increases of tenderness in postmortem age. It seems probable that the resolution of the rigor with postmortem age of the meat is primarily not due to proteolysis to small peptides and amino acids as commonly thought, but to the disintegration of the contractile muscle proteins, such as the dissociation of the actomyosin threads into their components, actin and myosin, and these are the changes which contribute to increases in tenderness.

These observations support this hypothesis: The amount of total N extracted increases with postmortem age; from the solubility studies this increase is thought to be due to an increase in actin and myosin as a result of the dissociation of the actomyosin complex.

Some points for further investigation resulting from the observations recorded have been indicated.

APPENDIX

The method of Neuman and Logan[2] for the determination of hydroxyproline in protein mixtures has been rechecked and made suitable for the determination of this amino acid in meat hydrolysates as an index of connective tissue in beef.

Approximately 8 g. of water-meat slurry (1:1), 3 ml. of water, 10 ml. of 12 N hydrochloric acid, and 0.7 g. of stannous chloride were refluxed for seven hours at atmospheric pressure. The hydrolysates were neutralized by 6 N sodium hydroxide, brought to pH 8 with saturated sodium carbonate, and filtered to remove the precipitated stannous hydroxide.

One ml. of the filtrate containing approximately 40 mg. of fresh meat was taken for the colorimetric estimation of hydroxyproline. The strength of sodium hydroxide reagent as given originally by the authors (2.5 N) was changed to 3.5 N in order to obtain a more perfect straight line relationship between the optical density and the hydroxyproline concentration. The apparent optical density was corrected for the interference of tyrosine and the color of the hydrolysate. The tyrosine content of 36 carcasses investigated was 1.024 $\pm$ 0.008 per cent on a wet basis; tyrosine developed 1.27 per cent as much color as hydroxyproline did. With a Beckman DU spectrophotometer, optical density measurements were made at 560 mμ.

The hydroxyproline concentration was read from a standard curve prepared from hydroxyproline samples subjected previously to the acid hydrolysis treatment; it was found that 13.5 $\pm$ 0.7 per cent of hydroxyproline content was destroyed on the hydrolysis. The reproducibility of the method is $\pm$2 per cent; however, the difficulty encountered in the sampling procedure raised the error up to $\pm$5 per cent.

The amount of hydroxyproline in the connective tissue (alkali insoluble proteins) of the longissimus dorsi muscle was found to be 12.39 $\pm$ 0.20 per cent. Consequently the factor used for the conversion of hydroxyproline values into its equivalent connective tissue was 8.07. From the knowledge of the content of hydroxyproline in collagen (gelatin) (14.41 $\pm$ 0.07 per cent), elastin (1.91 per cent), and the connective tissue (12.39 per cent), it was calculated that the connective tissue of the shortloin muscle consisted of 84 per cent collagen and 16 per cent elastin.

The alkaline hydrolysis of beef was used during the first year of the research. However, it was found that alkaline hydrolysis is of value only in the case when tryptophan determination is one of the main objectives of the study. The presence of fat in the hydrolysis mixture influenced additionally a destruction of tryptophan. The destruction increased proportionately with the higher fat content. Microfilm $3.15; Xerox $10.80. 243 pages.

1. Deatherage, F. E., Reiman, Walter. "Measurement of Beef Tenderness and Tenderization of Beef by Tenderay Process," Food Research, 11, No. 6 (1946), pp. 525-34.

2. Neuman, R. E., and Logan, M. A. "The Determination of Hydroxyproline," J. Biol. Chem., 184 (1950), pp. 299-306.

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CARBON DIOXIDE FIXATION BY CELL-FREE EXTRACTS OF ASPERGILLUS NIGER

(L. C. Card No. Mic 59-2784)

Charles Louis Woronick, Ph.D.
The University of Wisconsin, 1959

Supervisor: Dr. Marvin J. Johnson

Aspergillus niger 72-4 ferments sucrose or glucose to citric acid in high yields when grown on a medium in which the trace-metal content is closely controlled. Previous work had shown that the glucose is cleaved symmetrically to give two 3-carbon fragments. One of these fragments is converted to CO_2 plus acetyl coenzyme A, while the other condenses with the CO_2 to form malic acid or oxalacetic acid. Finally, the acetyl coenzyme A condenses with oxalacetate to form citrate.

Cell-free extracts of A. niger 72-4 were found to contain 2 different systems for synthesizing C_4-dicarboxylic acids by condensing CO_2 with 3-carbon units. One of the systems requires phosphoenolpyruvate, adenosinediphosphate, magnesium or manganese ions, and potassium or ammonium ions. Inosinediphosphate was about 1/4 as effective as adenosinediphosphate. The monovalent cation requirement could not be met with sodium or lithium ions, and the divalent cations could not be replaced by Ca^{++}, Ba^{++}, Co^{++}, Ni^{++}, Cu^{++}, or Zn^{++}.

The reaction was measured by determining the amount of radioactive CO_2 that was fixed. The major radioactive products were identified by paper chromatography as aspartic, malic and fumaric acids. Oxalacetate accounted for only 0.47% of the radioactivity. Addition of glutamic acid to the reaction mixture increased the amount of radioactivity that appeared in the aspartic acid, while the addition of reduced diphosphopyridine nucleotide increased the amount of radioactivity in the malate and fumarate. The malate and fumarate were in equilibrium with one another. These results indicate that the initial radioactive product was oxalacetate, and that the oxalacetate was converted to aspartate by transamination, and to malate by reduction.

The second CO_2-fixing system involves pyruvate and adenosinetriphosphate, and probably yields oxalacetate as the initial radioactive product. The major radioactive products were aspartate, malate and fumarate. The products were present in the same ratios as in the phosphoenolpyruvate plus adenosinediphosphate system.

Glucose-6-phosphate dehydrogenase was present in the extract, but no malic enzyme activity was detected. The enzymatic fixation of CO_2 onto phosphoenolpyruvate to form inorganic phosphate and oxalacetate could not be detected.

Microfilm $2.00; Xerox $5.80. 119 pages.

CHEMISTRY, INORGANIC

STUDY OF THE McFADYEN-STEVENS ALDEHYDE SYNTHESIS

(L. C. Card No. Mic 59-2711)

Edward George Caflisch, Jr., Ph.D.
The Ohio State University, 1954

One of the newer methods for the preparation of aldehydes from the corresponding acids, the McFadyen-Stevens procedure,[1] has been used successfully for aromatic (usually 65-80 per cent yield) and heterocyclic (usually 30-65 per cent yield) aldehydes. Reported attempts to prepare ortho- or para-nitro substituted benzaldehydes have always failed, but these are the only cases of failure in the aromatic series. The method has always been unsatisfactory in the aliphatic series except for the case of cyclopropanecarboxaldehyde.[2] In this procedure the acid (I) was converted to the corresponding acylarylbenzenesulfonhydrazide (II), which was then cleaved to the aldehyde (III) with a large excess of solid sodium carbonate.

$$\underset{\text{I}}{ArCO_2H} \longrightarrow ArCO_2R \longrightarrow ArCONHNH_2 \longrightarrow \underset{\text{II}}{ArCONHNHSO_2Ar'}$$

$$\underset{\text{II}}{ArCONHNHSO_2Ar'} + \tfrac{1}{2}Na_2CO_3 \longrightarrow \underset{\text{III}}{ArCHO} + N_2 + NaSO_2C_6H_5 + \tfrac{1}{2}H_2O + \tfrac{1}{2}CO_2$$

This alkali (two mole excess) was added, all at once, to the sulfonhydrazide (II), which was dissolved in hot ethylene glycol (150-165°). When the violent evolution of nitrogen subsided (one to three minutes), the mixture was rapidly cooled and the aldehyde (III) isolated in the usual manner. A disadvantage of this procedure was the rapid decrease in yield with prolonged heating. The yield of benzaldehyde dropped from 73 (75 seconds at 160°) to 10 per cent when the reaction time was about seventeen minutes 140 → 190°).[1] Little has been reported about side reactions or the reaction mechanism. The reaction appears to be analogous to the two reactions formulated below,[1,3] and similar intermediates (IV and V) have been postulated for the three reactions.

$$ArNHNHSO_2Ar' + {}^-OH \longrightarrow \underset{\text{IV}}{[ArN{=}NH]} + {}^-SO_2Ar' + H_2O$$
$$[ArN{=}NH] \longrightarrow ArH + N_2$$

$$ArCONHNH_2 + 2OH^- \longrightarrow \underset{\text{V}}{[ArCON{=}NH]} + 2H_2O + 2e^-$$
$$[ArCON{=}NH] \longrightarrow \underset{\text{III}}{ArCHO} + N_2$$

$$\underset{\text{II}}{ArCONHNHSO_2Ar'} + OH^- \longrightarrow \underset{\text{V}}{[ArCON{=}NH]} + {}^-SO_2Ar' + H_2O$$
$$[ArCON{=}NH] \longrightarrow \underset{\text{III}}{ArCHO} + N_2$$

The study of the McFadyen-Stevens procedure was commenced with the aim of modifying the conditions so that the reaction would occur at a more measurable rate. Strong bases such as potassium butylate removed a proton from N'-benzenesulfonylbenzhydrazide (N' refers to the unsubstituted nitrogen of the hydrazide from which the name is derived), but the resulting salt was not cleaved to benzaldehyde unless the temperature was high. Sodium N'-benzenesulfonylbenzhydrazide was found to be very stable at room

temperature and could be reconverted to N'-benzenesulfonylbenzhydrazide in 96 per cent yield on treatment with acid. A study of the pyrolysis of solutions of this salt in ethylene glycol showed that the preparation of benzaldehyde was surface catalyzed. Every solid which was tested catalyzed the reaction, but powdered glass or glass wool gave the best results. When this salt was added to a suspension of glass wool in hot ethylene glycol (160-165° for 4 minutes), benzaldehyde in 78 per cent yield (determined as the 2,4-dinitrophenylhydrazone) was formed. The yield of aldehyde was now only slightly effected by prolonged heating, but the high temperature with a short reaction time was still advantageous (see Fig. 1). The excess sodium

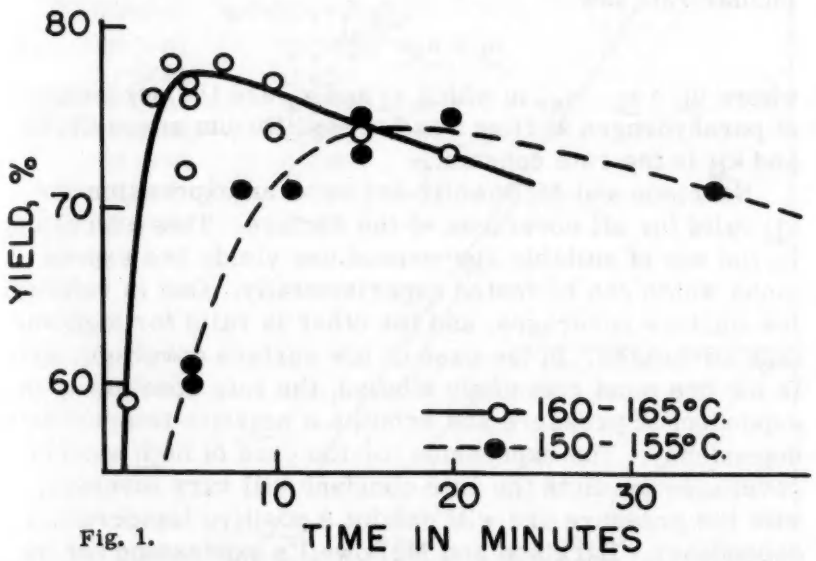


Fig. 1.

carbonate required for the reported procedure was apparently needed mainly to provide surface; for one equivalent of sodium carbonate in the presence of powdered glass was sufficient to give benzaldehyde in the same yield as obtained from the salt.

The highest yield of benzaldehyde (81 per cent) was obtained when 1.1 equivalents of sodium carbonate was added to a suspension of powdered glass in a hot solution (160-165° for 4 minutes) of N'-benzenesulfonyl-benzhydrazide in ethylene glycol. This procedure was found to give improved yields with a series of aromatic and heterocyclic aldehydes (see Table I). The yields of these aldehydes were only slightly effected by prolonged heating. If the aldehydes were not so sensitive to alkali, a large excess of sodium carbonate would apparently be advantageous; for the 59 per cent yield of 2-hydroxybenzaldehyde (which does not undergo the Cannizzaro reaction) was obtained when five equivalents of sodium carbonate was used. This improved procedure did not give a more measurable rate but did eliminate the decomposition of the desired aldehyde as a factor in the yield.

There are many mechanisms which could be postulated for the McFadyen-Stevens reaction, but the discussion will be limited to the previously postulated reaction path. The first step is very likely the loss of a proton. Both hydrogens on the nitrogens of N'-benzene-sulfonylbenzhydrazide are activated, and either one might be lost.

$$ArCONHNHSO_2Ar' + OH^- \rightleftharpoons Ar\overset{H}{\overbrace{C}}ONNSO_2Ar' + H_2O$$

The salt in solution is apparently a mixture of the possible ions, since a mixture of products was obtained when the salt was alkylated with methyl sulfate or methyl iodide at

TABLE I

Yields of Aldehydes

Aldehyde	Highest Reported Yield, Per Cent	Highest Yield By Improved Procedure, Per Cent
C_6H_5CHO	73	81
$2\text{-}HOC_6H_4CHO$	55	59
$3\text{-}NO_2C_6H_4CHO$	42	52
$4\text{-}NO_2C_6H_4CHO$	0	4
$4\text{-}NH_2C_6H_4CHO$*		36
$2,4,6\text{-}(CH_3)_3C_6H_2CHO$*		38
Pyridine-3-carboxaldehyde*	36	64
Furane-2-carboxaldehyde*		64

*The following corrected melting points were observed:
$4\text{-}NH_2C_6H_4CONHNHSO_2C_6H_5$, 200.5-203°;
$2,4,6\text{-}(CH_3)_3C_6H_2CONHNH_2$, 153° (uncorrected);
$2,4,6\text{-}(CH_3)_3C_6H_2CONHNHSO_2C_6H_5$, 205.6-206°;
2,4,6-trimethylbenzaldehyde 2', 4'-dinitrophenylhydrazone, 256-257°;
pyridine-3-carboxaldehyde 2', 4'-dinitrophenylhydrazone, 258.5-259.5°;
N'-benzenesulfonylfurane-2-carbohydrazide, 185.5-187.2°.

room temperature. The loss of the benzenesulfinate anion as the second step in a heterolytic cleavage is more reasonable than the loss of the benzoyl carbanion.

$$Ar\overset{H}{\overbrace{C}}ONNSO_2Ar' \longrightarrow [ArCON_2H] + {}^-SO_2Ar'$$

In support of this belief N,N'-dibenzoylhydrazine was not affected by heat and alkali, and N,N'-bis-(benzenesulfonyl)-hydrazine was cleaved to benzenesulfinic acid and nitrogen by heat alone. The conventional 1,2-elimination of the benzenesulfinic acid could only occur through anion VI, but the theoretically possible 1,1-eliminations could occur with anions VIII and X.

$$\begin{array}{l} C_6H_5\overset{-}{C}ONNHSO_2C_6H_5 \\ \quad\quad\updownarrow \\ C_6H_5C(O^-)=NNHSO_2C_6H_5 \end{array} \quad (VI) \longrightarrow [C_6H_5CON{=}NH] + {}^-SO_2C_6H_5 \quad (VII)$$

$$C_6H_5\overset{-}{C}ONHNSO_2C_6H_5 \longrightarrow [C_6H_5CON{=}NH] \text{ or } [C_6H_5C\overset{+}{O}NH{=}\overset{-}{N}] + {}^-SO_2C_6H_5$$
(VIII) (VII) (IX)

$$C_6H_5C(OH){=}N\overset{-}{N}SO_2C_6H_5 \longrightarrow [C_6H_5C(OH){=}\overset{+}{N}{=}\overset{-}{N}] + {}^-SO_2C_6H_5$$
(X) (XI)

The neutral intermediate (VII, IX, or XI) is expected to be unstable and to give immediately the aldehyde and nitrogen. There is not sufficient information to allow a choice of one of these or of the many other mechanisms which can be written for the McFadyen-Stevens procedure. The catalytic effect of surfaces in this reaction also is not understood.

The alkylation of sodium N'-benzenesulfonylbenzhydrazide gave two monomethyl derivatives and one dimethyl derivative. A third monomethyl derivative (m.p. 145-145.3°, corrected) was the only product from the benzoylation and benzenesulfonylation of methyl hydrazine formulated below. This compound had 75% of the required N-methyl.

$$CH_3NHNH_2 \xrightarrow{C_6H_5COCl} [C_6H_5CON(CH_3)NH_2] \xrightarrow{C_6H_5SO_2Cl} C_6H_5CON(CH_3)NHSO_2C_6H_5 \ 38\%$$
$$\xrightarrow{C_6H_5CHO} C_6H_5CON(CH_3)N{=}CHC_6H_5 \ 38\%$$

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The monomethyl derivative with m.p. 188-189.2° (corrected), which was obtained from the alkylation in 57 per cent yield, was assigned structure XII since analysis indicated no methoxy and 67 per cent of the required N-methyl.

$C_6H_5CONHN(CH_3)SO_2C_6H_5$ XII

$C_6H_5C(OCH_3)=NNHSO_2C_6H_5$ XIII

The monomethyl derivative, with m.p. 164.5-166° (corrected), which was obtained in 21 per cent yield, was tentatively assigned to the remaining structure (XIII). The methoxy determination was only 3 per cent of the required value for this structure (N-methyl was 16 per cent of that required for structure XII). The dimethyl derivative with m.p. 91-92.5° (corrected), which was obtained in 9 per cent yield, was assigned structure XV since the methoxy determination was 50 per cent of the required value.

$C_6H_5CON(CH_3)N(CH_3)SO_2C_6H_5$ XIV

$C_6H_5C(OCH_3)=NN(CH_3)SO_2C_6H_5$ XV

Microfilm $2.00; Xerox $4.20. 78 pages.

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Abstract published by special arrangement with The Ohio State University.

THE SURFACE CATALYSIS OF THE ORTHO TO PARA CONVERSION IN HYDROGEN UNDER PRESSURE AT LIQUID NITROGEN TEMPERATURE

(L. C. Card No. Mic 59-2712)

Douglas Scott Chapin, Ph.D.
The Ohio State University, 1954

The surface catalysis of the ortho to para conversion in hydrogen was investigated on a series of chromia-alumina catalysts under pressures in the range 5 to 100 atmospheres at low temperatures. The rate data support the theory of Harrison and McDowell,[1] who have recently adapted the Wigner[2] theory to the case of the heterogeneous ortho-parahydrogen conversion occurring in a physically adsorbed layer. This research constitutes the first quantitative test of this theory for the case of complete surface coverage.

The catalysts were prepared by impregnating pelleted γ-alumina with various concentrations of chromic acid, then washing, drying, and reducing with hydrogen. The adsorption of chromic acid by acid-leached γ-alumina varied linearly with initial chromic acid concentration up to a saturation adsorption corresponding to 1.76 per cent chromia-alumina. Chromic acid adsorbed below the saturation point was regarded as forming a monolayer. Nitrogen and hydrogen surface areas determined by the B.E.T. isotherm method were independent of chromia content, though different in magnitude for the two gases. Hydrogen was purified specially by a process which included filtration of the liquid and distillation, and was compressed by the vaporization of confined liquid hydrogen.

Rate data was obtained by the static method with a stainless steel catalyst chamber from which samples of hydrogen were withdrawn from time to time. Analyses of the ortho-parahydrogen mixtures were made by the Farkas micro-thermal conductivity method.[3] A commercially available Pirani gauge[4] was found to make an extremely stable cell when encased in mercury. This cell was operated with a Wheatstone bridge ratio of 1:1000 at a pressure of 0.05 mm. Hg. The conversion followed the usual unimolecular rate law

$$u_t = u_0 e^{-k_H t} \qquad (1)$$

where $u_t = x_t - x_e$, in which x_t and x_e are the percentages of parahydrogen at time t and at equilibrium respectively and k_H is the rate constant.

Harrison and McDowell[1] arrive at an expression for k_H valid for all coverages of the surface. This expression by the use of suitable approximations yields two expressions which can be tested experimentally. One is valid for low surface coverages, and the other is valid for high surface coverages. In the case of low surface coverage, which is the one most commonly studied, the rate constant is independent of pressure and exhibits a negative temperature dependency. The expression for the case of high surface coverages predicts the rate constant will vary inversely with the pressure and will exhibit a positive temperature dependency. Harrison and McDowell's expression for the rate constant k_H for the case of high surface coverage is given by

$$k_H = \frac{s\rho a K \vartheta (RTM)^{\frac{1}{2}} G(T) \overline{\ell^2}}{\sqrt{2}\, r_s^8\, NPv\, \ell_m} \qquad (2)$$

where s is the total surface area of the catalyst in cm.^{2}, ρ is the number of active sites per cm.^{2}, a is the area per site in cm.^{2}, ϑ is the number of molecules per cm.^{2} in a complete monolayer, r_s is the mean distance of a hydrogen molecule from the surface in a physically adsorbed layer, P is the pressure, v is the volume of the system, T is the absolute temperature, M is the molecular weight of hydrogen, R is the gas constant, N is Avogadro's number, $\overline{\ell^2}/\ell_m$ is the ratio of the mean square path to the mean path across a circle of interaction for a molecule moving in the adsorbed layer. Also in equation (2) K is given by

$$K = \frac{24 \mu_a \mu_p I \pi^2}{h^2 m} \qquad (3)$$

where μ_a is the magnetic moment of each surface site, μ_p is the proton magnetic moment, I is the moment of inertia of a hydrogen molecule of mass m, and h is Planck's constant. $G(T)$ in equation (2) is given by

$$G(T) = \left\{1 + \frac{n_p(T)}{n_0(T)}\right\} \left\{ \frac{\sum_{J=0,1,2,\ldots} J \exp(-E_J/kT)}{\sum_{J=0,2,4,\ldots} (2J+1)\exp(-E_J/kT)} \right\} \qquad (4)$$

where $n_p(T)$ and $n_0(T)$ are respectively the equilibrium concentrations of para and of orthohydrogen at the temperature T, J is the rotational quantum number, and E_J is the rotational energy of the molecule in the state J given by

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$$E_J = J(J+1)\,h^2/(8\pi^2 I).$$

From equation (2) the rate constant k_H is proportional to $\gamma C T^{\frac{1}{2}} G(T)/P$, where C is the site concentration $s\rho/N$ in the catalyst chamber in mols. $G(T)$ is given by equation (4) and is obtained from the Wigner[2] theory, which allows for the ortho-parahydrogen equilibrium and heats of transitions among the rotational states. The factor $\gamma = PV/RT$ is introduced here to allow for gas imperfection.

A small blank correction was applied to the experimental rate constants. Rate data for several chromia-alumina concentrations are plotted in Fig. 1 as half-life vs.

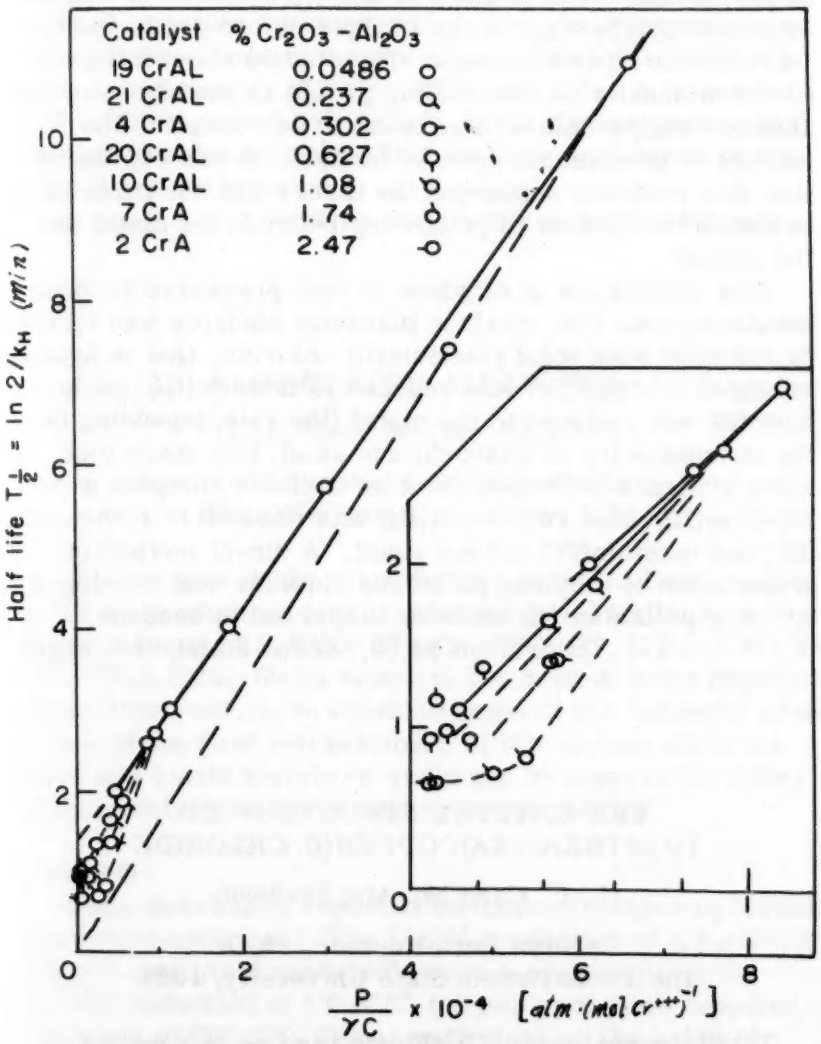


Fig. 1. Pressure and Concentration Dependency of the Ortho to Para Hydrogen Conversion on Chromia-Alumina at 77°K.

$P/(\gamma C)$ for the ortho-parahydrogen conversion at 77° K. The half-life increases almost linearly at higher pressure-concentration ratios. Data for 0.0486 and 0.237 per cent chromia-alumina are plotted in Fig. 2 as rate constant k_H vs. $\gamma C T^{\frac{1}{2}} G(T)/P$ at 77° K. and for the lower concentration at approximately 28 atmospheres at various temperatures. At higher pressures (higher surface coverages) the 77° K. curve bends in toward the origin and more closely approximates the behavior predicted for complete coverage. A straight line through the points for various temperatures does not quite intersect the origin. This probably is due to incomplete coverage of the surface. It is observed in Fig. 2 that the rate constant at high pressures (high surface coverage) varies approximately inversely with the pressure and exhibits a positive temperature dependency as predicted by equation (2).

From an Arrhenius plot of the specific reaction rate a

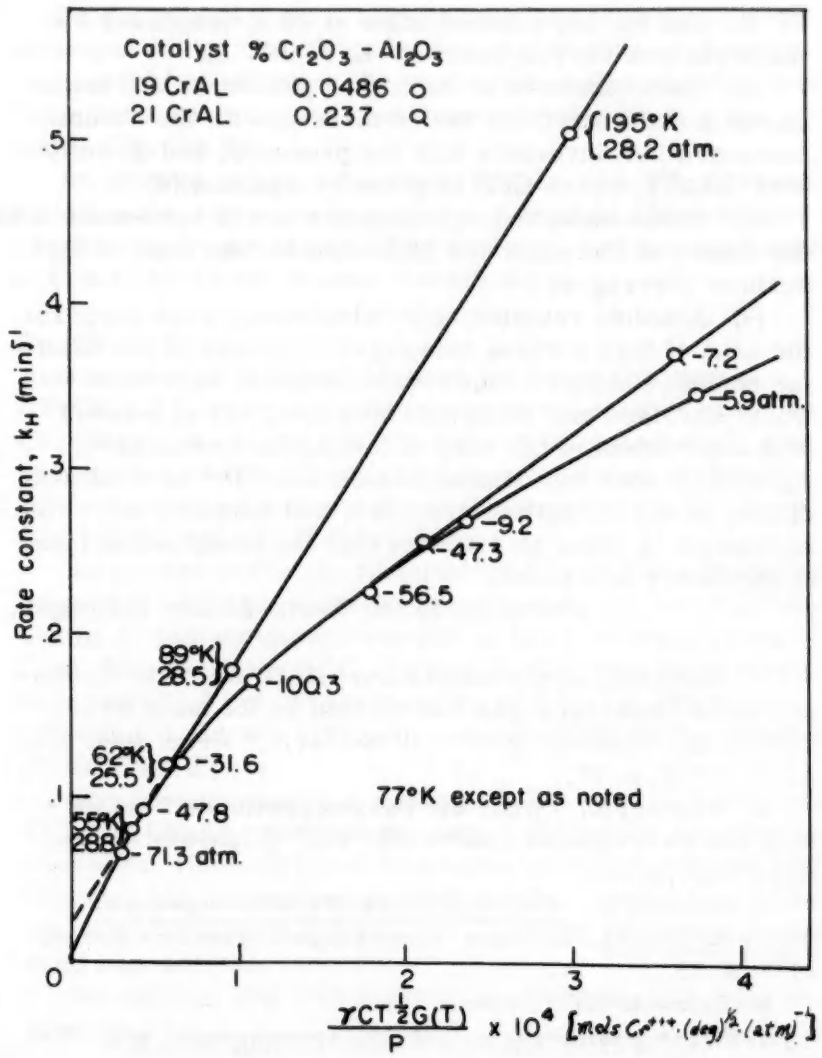


Fig. 2. Plot of Rate Data According to the Harrison-McDowell Equation for High Surface Coverage.

value of 56 cal. mole^{-1} was found for the activation energy for the heterogeneous ortho-parahydrogen conversion on 0.0486 per cent chromia-alumina. This very low energy of activation is taken as evidence that the reaction is taking place in a physically adsorbed layer of hydrogen.

Absolute reaction rate calculations were made by Harrison and McDowell for the case of low surface coverage by assigning "reasonable" values to the constants, and good agreement between the theoretical and the calculated rate constants was obtained. For the case of high surface coverages, absolute reaction rate calculations were made by means of the same assignment of values for the constants common to both expressions, and agreements between the theoretical and experimental values for the rate constants were obtained for several conditions of concentration, pressure, and temperature.

While the closeness of agreement in the two cases depends very strongly on the exact choice of values for the constants, it is significant that a choice of values which gave agreement between the theoretical and experimental rate constants for the case of low surface coverages also gave good agreement for the case of high surface coverages in spite of the use of different catalyst systems.

CONCLUSIONS

(1) The heterogeneous ortho-parahydrogen conversion has been investigated on chromia-alumina catalysts in the concentration region 0 to 3 weight per cent chromia-alumina at pressures varying from 5 to 100 atmospheres at

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77° K., and for one concentration at 28 atmospheres and temperatures varying from 55° K. to 195° K.

(2) Rate constants at the higher pressures and lower chromia concentrations varied directly with the chromia concentration, inversely with the pressure, and directly with $T^{\frac{1}{2}}G(T)$, where G(T) is given by equation (4).

(3) These observed dependencies are in agreement with the theory of Harrison and McDowell for the case of high surface coverages.

(4) Absolute reaction rate calculations were made for the case of high surface coverages by means of the values for certain constants which were identical with those with which Harrison and McDowell obtained good agreement with experiment in the case of low surface coverages. Agreement with experiment was obtained for several conditions of concentration, pressure, and temperature. This agreement is taken as evidence that the fundamental ideas of the theory are sound.

Microfilm $2.00; Xerox $5.20. 102 pages.

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Abstract published by special arrangement with The Ohio State University.

PLATINUM GROUP METAL-OLEFIN COMPLEXES

(L. C. Card No. Mic 59-2738)

Sydney Arthur Giddings, Ph.D.
The Ohio State University, 1959

Platinum-olefin complexes were first prepared more than a century ago, but until very recently the structure of the complexes and type of bonding were only conjecture. Many theories have been proposed but now it is generally accepted that the metal-olefin linkage is formed by overlap of the dsp^2 orbital of platinum(II) with the pi orbital of the ethylenic ligand.

A method of preparation of the primary members of the series, Zeise's salt (potassium trichloroethylene platinum (II)) and ethylene platinous chloride(1,3-dichloro-2,4-bis-ethylene-μμ-dichloro platinum(II)), was developed by using ethylene at pressures up to sixty atmospheres. High yields were obtained with greatly reduced reaction times. The kinetics of the preparation of Zeise's salt from ethylene and potassium chloroplatinite was investigated. The metal was studied spectrophotometrically and found to behave as first order, as did the ethylene which was studied by means of the Warburg apparatus. Further experiments proved that the overall reaction was second order, confirming the first experiments. A check of the two isosbestic points of potassium chloroplatinite and Zeise's salt showed that only the reactant and product were present in any appreciable concentration. Hence, an addition reaction must have occurred, followed by rapid decomposition of the unstable intermediate which must have a higher coordination number than the square planar complexes present initially and finally.

In order to study the trans effect, substituted styrenes were prepared and used to replace the ethylene in ethylene platinous chloride. The complexes were studied by ultraviolet and infrared spectroscopy; by displacing power, measured by determining the pressure of ethylene evolved in the substitution reaction; by reduction with hydrogen gas; and by elemental analysis used to determine the ratio of the normal dimeric species and the monomeric species, produced by cleavage of the bridged chloro group and the introduction of extra ligand. The studies showed that the electron density on the olefinic group, as measured by the Hammet sigma values, was found to be related to the amount of monomeric species formed. It was concluded that this evidence supported the theory that the trans effect is due to the amount of pi bonding between the metal and the ligand.

The application of ethylene at high pressures to other metals showed that ethylene platinous chloride was formed by reaction with solid platinum(II) chloride; that in aqueous solutions iridium(IV) was reduced to iridium(III), palladium(II) was reduced to the metal (the rate depending on the concentration of hydrochloric acid), that there was some evidence of formation of an unstable complex with rhodium(III), that ruthenium(III) was reduced to ruthenium-(II), and osmium(IV) did not react. A direct method of preparation of ethylene palladous chloride was developed by using palladium(II) chloride dispersed in benzene.

Microfilm $2.00; Xerox $6.60. 137 pages.

THE CRYSTAL STRUCTURE OF TRIS(THIOUREA)COPPER(I) CHLORIDE

(L. C. Card No. Mic 59-2890)

Carolyn Berk Knobler, Ph.D.
The Pennsylvania State University, 1959

Tris(thiourea)copper(I) chloride is one of a series of coordination compounds of monovalent copper with thiourea. The study of the crystal structure of this compound was undertaken in an effort to determine the type of coordination and the configuration of the cation in the solid.

Three-dimensional x-ray diffraction data were collected using CuKα radiation and the Weissenberg moving-film method. The crystal is in space group $P4_12_12$ (or $P4_32_12$), and has unit-cell dimensions of a = 13.41, c = 13.79 A. The structure was solved in three-dimensions using the Patterson function and the electron-density function. Refinement proceeded in three dimensions using the IBM 704 Electronic Data-Processing Machine with the method of least squares. The final disagreement factor in three dimensions is R = 0.186 for $F_{obs} \neq 0$.

The copper atom is located at the center of a slightly distorted tetrahedron with four sulfur atoms at the corners, at distances of 2.31_3, 2.34_6, 2.38_4, and 2.42_4 A, making S-Cu-S angles of 112°, 110°, 101°, 106°, 110°, and 118°. Two of these four sulfur atoms also are at corners of neighboring tetrahedra, forming the links in a spiral chain

of tetrahedra around each 4_1 axis. The Cu-S distances for the shared sulfur atoms are longer than those for the unshared atoms.

The shape of the thiourea ligands is somewhat different from that of uncoordinated thiourea. In the thiourea ligand containing the shared sulfur atom, the C-S distance is 1.80 A, the C-N distances are 1.24 and 1.29 A, and the N-C-N angle is 130°. In another thiourea ligand, the C-S distance is 1.82 A, the C-N distances are 1.29 and 1.40 A, and the N-C-N angle is 121°. Similar shape and size are also found in the third thiourea ligand. The bond distances and angles of uncoordinated thiourea ligands are compared. All the thiourea ligands are planar within the experimental error.

Each chloride ion is surrounded by six nitrogen atoms. Of these six atoms, three can be considered as hydrogen bonded at distances of 3.25_2, 3.26_5 and 3.31_3 A forming C-N···Cl angles of 95°, 93° and 104°. Comparison with the previous data suggests that the hydrogen bonds in this crystal are rather weak.

Microfilm $2.00; Xerox $4.80. 92 pages.

FLUORINATED ALDEHYDES

(L. C. Card No. Mic 59-2722)

Delmar Dean Krehbiel, Ph.D.
The Ohio State University, 1954

The purpose of the work discussed in the dissertation is (1) to prepare an homologous series of trifluoro aldehydes, namely, CF_3CHO, CF_3CH_2CHO, $CF_3(CH_2)_2CHO$, and $CF_3(CH_2)_3CHO$; (2) to establish the drift of their physical properties; and (3) to examine some of the chemical properties of the first two members of the series, since the third and fourth members would not be expected to differ significantly from their unfluorinated analogs.

CF_3CHO

Some previously reported methods of preparing fluoral were reinvestigated. The $LiAlH_4$ reduction of CF_3COOH[1] (26 per cent yield reported) seemed preferable to the $LiAlH_4$ reduction of CF_3CN[2] (46 per cent yield reported on the basis of CF_3CN; 36 per cent yield on the basis of CF_3COOH), and an attempt was made to improve the percentage of yield and the experimental procedure for this reduction. The procedure was modified and improved to give fluoral in 90 per cent conversion from CF_3COOH.[3]

Upon reinvestigation it was found that fluoral could be obtained by the Stephen's reduction of CF_3CN, which had previously been reported unsuccessful.[3]

The intermediate fluoral hydrate was dehydrated to fluoral with polyphosphoric acid, which is more effective and accompanied by less polymerization or decomposition than concentrated H_2SO_4 or P_2O_5.

An attempt to convert fluoral hydrate to $CF_3CHOH(NH_2)$, which could then presumably be deammoniated with a weak acid to give pure fluoral with little polymerization or decomposition, resulted in the discovery of $(CF_3CH{=}NH)_3$, which was visualized as the cyclic hexahydrotriazine. This material gives the 2,4-dinitrophenylhydrazone of CF_3CHO and is soluble in organic solvents at low temperatures, which may make it possible to utilize it in place of CF_3CHO, which polymerizes at low temperatures.

This material (cyclic hexahydrotriazine) could possibly be prepared by catalytic reduction of $(CF_3CN)_3$ and would be a method of obtaining the equivalent of fluoral selectively if the hexahydrotriazine ring does not break to give the amine $CF_3CH_2NH_2$.

An attempt to react the imine trimer with CH_3MgBr resulted in the evolution of methane, indicating the presence of acidic hydrogen atoms. The nature of and potential uses of this trimer need further investigation.

CF_3CH_2CHO

The most promising approach to the preparation of CF_3CH_2CHO was the previously reported method based on $CF_3CH_2CH_2X$ (X = Cl, Br, or I) as an intermediate.[2] The preparation of $CF_3CH_2CH_2X$ is important also in that it can serve as an intermediate in the preparation of $CF_3(CH_2)_2CHO$ and $CF_3(CH_2)_3CHO$.

An alternative to the fluorination of $CCl_3CH_2CH_2Cl$ was attempted because this material became commercially unavailable and equipment was not on hand for its preparation. The addition of CCl_3Br to $CH_2{=}CH_2$ was carried out successfully,[4] but the fluorination of $CCl_3CH_2CH_2Br$ to $CF_3CH_2CH_2Br$ was not clean-cut and yields of the desired product were poor.

The development of a method for conveniently producing $CCl_3CH_2CH_2Cl$ prompted the use of the previously reported successful fluorination of this material to $CF_3CH_2CH_2Cl$.[5] Fluorination attempts gave such erratic results in percentage of yield to the $CF_3CH_2CH_2Cl$ that the route was considered impractical.

An attempt was then made to improve the following series: $CH_3CHClCH_2Cl \xrightarrow{Cl_2;\ (Fe)} CH_3CHClCHCl_2 \xrightarrow{aq.\ NaOH} CH_3CH{=}CCl_2 \xrightarrow{excess\ HF} CF_3CH_2CH_3 \xrightarrow{Cl_2;\ U.V.} CF_3CH_2CH_2Cl$. The use of SbF_3 as catalyst in converting $CH_3CH{=}CCl_2$ to $CF_3CH_2CH_3$ with an excess of HF gave a higher percentage of conversion to $CF_3CH_2CH_3$ than the use of excess HF without a catalyst and reduced the time necessary for this conversion to take place.

The $CF_3CH_2CH_2Cl$ obtained upon selective chlorination of $CF_3CH_2CH_3$ was converted to $CF_3CH_2CH_2OH$, as previously reported,[2] by means of a slightly modified procedure in the hydrolysis of the corresponding Grignard reagent. An attempt to oxidize $CF_3CH_2CH_2OH$ no further than CF_3CH_2CHO (according to a previously reported procedure[2]) gave only 15 to 20 per cent pure CF_3CH_2CHO and much unreacted $CF_3CH_2CH_2OH$, and indicated that the reported 57 per cent yield may have been based on crude product obtained.

A modified Oppenauer oxidation of n-propanol to propionaldehyde failed.

A method for converting n-propanol to propionaldehyde in 45 per cent conversion by the acid-dichromate method[6] was reinvestigated and improved to give propionaldehyde in 65 per cent conversion. When the method was applied to $CF_3CH_2CH_2OH$, only 40 per cent conversion of CF_3CH_2CHO could be obtained. Side products were $CF_3CH_2COOCH_2CH_2CF_3$, CF_3CH_2COOH, and unreacted $CF_3CH_2CH_2OH$.

An attempt to reduce CF_3CH_2COOH to CF_3CH_2CHO with $LiAlH_4$ gave a poor percentage of conversion,[3] and although offering a higher possible percentage of yield, the oxidation of the alcohol to the aldehyde is still preferable.

An attempt to prepare CF_3CH_2CHO by the addition of CF_3I to vinyl acetate and hydrolysis failed.

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Attempts to dry the CF_3CH_2CHO with anhydrous sodium sulfate and Drierite were ineffective. Distillation of various samples of CF_3CH_2CHO from P_2O_5 give varying index values, indicating possible loss of HF to CF_2=CHCHO, which was later verified by analysis of the percentage of F.

The reaction of CF_3CH_2CHO (distilled from P_2O_5) with C_6H_5MgBr gave indications that the expected addition occurs and is the predominant reaction but that dehydration of this product to the olefin and polymerization of C_6H_5CH=$CHCF_3$ and/or CF_2=CHCHO (resulting from loss of HF) also occur to a considerable extent.

The reaction of CF_3CH_2CHO (distilled from Drierite and therefore not completely dry) with excess C_2H_5MgBr gave some expected addition product but gave predominantly polymerization products and some olefin. The MgBr(OH) formed from the reaction of the C_2H_5MgBr and water present probably acts as a base of sufficient strength to remove HF from CF_3CH_2CHO.

It is concluded that it is necessary to obtain CF_3CH_2-CHO free of all water and CF_2=CHCHO to determine more accurately what its behavior toward Grignard reagents is.

$CF_3CH_2CH_2CHO$

This aldehyde was prepared according to a previously reported method,[7] a slight modification in the method being used for regenerating the aldehyde from its sodium bisulfite addition product, namely, $Na_3PO_4 \cdot 12H_2O$.

$CF_3CH_2CH_2CH_2CHO$

This aldehyde was newly synthesized.

An attempt to condense $CF_3CH_2CH_2Br$ with diethyl malonate in an attempt to obtain $CF_3(CH_2)_3COOH$ gave exclusively dehydrohalogenation.

An attempt to add ethylene oxide to $CF_3CH_2CH_2MgBr$ to give $CF_3(CH_2)_3CH_2OH$ failed.

In anticipation of the necessary oxidation of $CF_3(CH_2)_3$-CH_2OH to the aldehyde, an attempt was made to oxidize n-amyl alcohol no further than its aldehyde with t-butyl chromate, but it was unsuccessful.

An attempt to improve the yields in the fluorination of $CCl_3(CH_2)_3CH_2Cl$ to $CF_3(CH_2)_3CH_2Cl$ with Freon 113 as a solvent instead of perchlorobutadiene[8] resulted in an increase of yield from 8 to 22 per cent, which is still impractically low.

The aldehyde was finally prepared from $CF_3CH_2CH_2X$ by carbonating the Grignard thereof and obtaining CF_3-$(CH_2)_2COOH$, which was reduced to the alcohol CF_3CH_2-CH_2CH_2OH.

An attempt was first made to convert the acid to its ethyl ester by an ester-acid interchange, but the interchange proved to take place much too slowly. The acid was therefore reduced to the alcohol directly with $LiAlH_4$.

The following series was then successfully carried out:

$$CF_3(CH_2)_3OH \xrightarrow{HBr} CF_3(CH_2)_3Br \xrightarrow{Mg;\ (Et_2O)} CF_3\text{-}(CH_2)_3MgBr \xrightarrow{HC(OEt)_3} CF_3(CH_2)_3CH(OC_2H_5)_2 \xrightarrow{H_2O;\ H^+} CF_3(CH_2)_3CHO.$$

PHYSICAL PROPERTIES

The physical properties of the aldehydes were determined and tabulated.

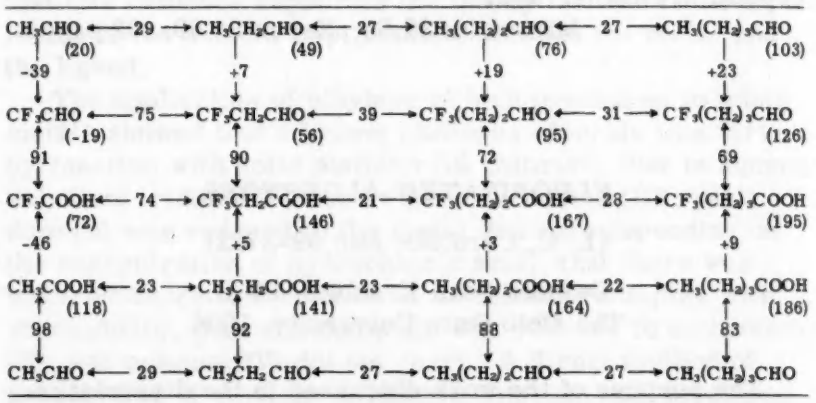
A boiling point comparison chart was prepared in which comparisons were made in differences of boiling points in going up the homologous series of fluorinated and unfluorinated aldehydes and acids and between aldehydes and acids, fluorinated and unfluorinated, containing the same number of carbon atoms. All boiling point values are given in degrees Centigrade.

Table I

Physical Properties of the Aldehydes

Compound	B.p. °C.	n_D^{20}	d_4^{20}	M.p. of 2,4-dinitrophenylhydrazone °C.	AR_F
CF_3CHO	-19 to -18			149-50	
CF_3CH_2CHO*	56 - 56.5	1.3176		150-51	
$CF_3(CH_2)_2CHO$	94.5-95.5	1.3309	1.2448	191-92	1.10
$CF_3(CH_2)_3CHO$	126	1.3480	1.1820	155-56	1.13

*These values were obtained on a sample of CF_3CH_2CHO and agree with those reported in the literature; however, it was difficult to obtain CF_3CH_2CHO both pure and dry and the n_D values varied among samples which had been dried in various ways and distilled.



The boiling point values (rounded to the nearest whole number) of the fluorinated compounds are those observed in this work. The boiling point values (rounded to the nearest whole number) of the unfluorinated compounds were taken from Lange's Handbook.[9]

Microfilm $2.00; Xerox $6.80. 143 pages.

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Abstract published by special arrangement with The Ohio State University.

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THE COMPLEXES OF IRON(II), COBALT(II), AND NICKEL(II) WITH LIGANDS CONTAINING THE CONJUGATED METHINE GROUP

(L. C. Card No. Mic 59-2752)

Robert Carl Stoufer, Ph.D.
The Ohio State University, 1959

The complexes which are formed by iron(II), cobalt(II), and nickel(II) with ligands of the aromatic heterocyclic diamines, e.g., 2,2'-bipyridine and o-phenanthroline, and the α-diimines, e.g., biacetylbismethylimine, have been well characterized. The iron(II) complexes of the form $[Fe(AA)_3]^{++}$ are spin-paired and octahedral, whereas those of the general form $[Fe(AA)_2X_2]$ are octahedral and spin-free (where AA represents a bidentate ligand and X represents any unidentate ligand). The cobalt(II) and nickel(II) complexes of the general form $[M(AA)_3]^{++}$ are spin-free and octahedral. These metals are also characterized by complexes of the form $[M(AA)_2X_2]$ which are reported to be octahedral. Even though ligands of the dipyridyl class form a wide variety of complexes with iron(II), cobalt(II), and nickel(II), the properties of the complexes of any given type which have been prepared by using a number of different ligand molecules are quite regular, i.e., the analogous complexes of these metals with ligands such as 2,2'-bipyridine, biacetylbismethylimine, and those of mixed type, e.g., pyridinalmethylimine, are quite similar. This presents a very consistent picture, since all of these ligand molecules contain the conjugated methine group and, hence, the same chelate ring. However, the complexes of these metals which have been prepared, by using the α-dioximes, e.g., dimethylglyoxime, are quite distinct from those formed with ligands of the dipyridyl class, even though both classes of ligand molecule contain the same conjugated methine group. Iron(II) is reported to form an unstable, four coordinate complex with dimethylglyoxime, while cobalt(II) and nickel(II) are best characterized by complexes of the form $[M(AA)_2]$ which are four coordinate, neutral, and spin-free. In addition, cobalt(II) and nickel(II) form complexes of the general form $[M(AA)_2X_2]$ which are octahedral and spin-free, similar to the analogous complexes of the dipyridyl series of ligands. There is one difference, however. The nickel(II) complexes of the form $[Ni(AA)_2X_2]$ which have been prepared by using ligands of the dipyridyl type react with water to form complexes of the type $[Ni(AA)_3]^{++}$, whereas those prepared by using ligands of the dimethylglyoxime type react with water to yield complexes of the form $[Ni(AA)_2]$.

During the course of this investigation, three new ligand molecules were used to prepare twelve complexes of iron (II), cobalt(II), and nickel(II) in order to determine whether they more closely resembled those complexes formed by the dipyridyl type of ligands or the dimethylglyoxime type of ligands. These ligands are biacetyldihydrozone, pyridinalhydrazone, and pyridindialdihydrazone. Five complexes of pyridinal-p-tolylimine were also prepared and studied. All of these ligand molecules contain the conjugated methine group, which is characteristic of both the dipyridyl and the dimethylglyoxime type of ligand. It was determined from the analytical data, the spectral properties, the magnetic properties, and conductance data of these complexes that they more closely resemble the complexes formed by these metals with ligands of the dipyridyl type than the complexes with ligands of the dimethylglyoxime type.

In an attempt to find ligand molecules which were more intermediate to the dipyridyl type of ligands, on the one hand, and the dioximes, on the other, three additional ligands were investigated, two of thich contained functional groups of both the oxime type and the hydrazone type. The three ligands that were studied are biactyloximemethoxime, biacetylhydrazoneoxime, and biacetylhydrazonemethoxime. These ligand molecules were used to prepare six different nickel(II) complexes. Conductance data and magnetic data of the complexes that were prepared indicate that those of the type $[Ni(AA)_2X_2]$ are octahedral and spin-free, whereas those of the type $[Ni(AA)_2]$ are neutral and spin-paired. Of these three ligands, only biacetylhydrazoneoxime formed complexes of all three types with nickel(II), i.e., $[Ni(AA)_3]^{++}$, $[Ni(AA)_2X_2]$, and $[Ni(AA)_2]$. The biacetylhydrazoneoxime complex of the type $[Ni(AA)_2X_2]$ may be reacted with water to produce either the six coordinate, spin-free complex or the four coordinate spin-paired complex by controlling the pH of the solution. Of all the ligands that were studied during the course of this investigation, only biacetylhydrazoneoxime was directly intermediate between the aromatic heterocyclic diamines, on the one hand, and the α-dioximes, on the other. Microfilm $3.65; Xerox $12.40. 284 pages.

COMPLEX EQUILIBRIA IN AQUEOUS AMINE MIXTURES

(L. C. Card No. Mic 59-2755)

Tawfiq Abed-Haj Youness, Ph.D.
The Ohio State University, 1959

The copper(II) equilibria in water and ethylenediamine mixtures has been investigated both with regard to the composition of the solvent and the complex species present. By means of vapor pressure investigations it was found that the vapor pressure of water decreased linearly until the mole ratio of water to ethylenediamine reached 2:1, proving the presence of the compound $enaq_2$ in essentially stoichiometric amounts. The vapor pressure measurement and thermometric titrations yielded good evidence for the compound enaq. It was possible to account for all the equilibria in terms of concentrations by assuming that the copper(II) ion was penta-coordinate and that each position is occupied by either an animo group or water. Furthermore, in the range containing excess free water, each uncomplexed amino group hydrated with one water molecule. Previous investigators who neglected this hydration obtained equilibrium constants that drifted badly with increasing amine concentration.

When spectrophotometric data were treated graphically, the results were perfectly linear and the calculated equilibrium constants and molar extinction coefficients were consistent with all experimental data. No evidence was detected for hexammine formation.

All aquo tetrammine complexes had a maximum extinction between 545 and 600 mu, and except for the triethylenetetramine complex, the molar extinction coefficients were less than 80. All pentammines had a maximum extinction between 610 and 645 mu, and their extinction coefficients were greater than 80. Evidence is presented to indicate that mono-(triethylenetetramine)-copper(II) ion is somewhat strained, which may be responsible for its high extinction coefficient. The high extinction coefficient of

mono-(tetraethylenepentamine)-copper(II) ion is largely due to pentammine formation and also to strain. Neither substitution nor replacement by ammonia was detected in tetraethylenepentamine complex of copper(II). The general equation for pentammine formation was found to be

$$CuA_4aq^{2+} + A'aq \rightleftharpoons CuA_4A'^{2+} + 2aq$$

where its equilibrium constant, Q, varied from 1100 for addition of ammonia to bis-(ethylenediamine)-copper(II) and tetracoordinated copper amine complexes to smaller values in the order 400 ± 100 when other monoamines were added. When ethylenediamine was bonded to the fifth position, Q decreased to 255. This was explained on the basis that only one of its amino groups was bonded.

It was found that two ammonia molecules replaced one ethylenediamine in bis-(ethylenediamine)-copper(II) and that one ammonia replaced one amino group of the ligand in mono-(triethylenetetramine)-copper(II). The former reaction occurred in a single step because of the relatively weak bonding of the polydentate amine.

In the complex bis-(diethylenetriamine)-copper(II) the replacement of one entire ligand by one ammonia occurred, since the remaining diethylenetriamine molecule occupied three of the four tetracoordinate positions. Then a second ammonia was added to form the pentammine complex.

When mixed complexes of the tetracoordinate positions were formed the stepwise constants became similar to those for the pure ammine complexes when statistical corrections were applied for the difference in the number of positions available or occupied by the stepwise added amine.

A survey was made of the polarography of these amines by using both the mercury and copper amalgam electrodes. All the monoamines yielded stepwise waves corresponding to the intermediate formation of copper(I) complexes. Ethylenediamine and other polyamines, as well, yielded single waves without intermediate formation of copper(I) complexes. In high concentrations of ethylenediamine the polarograms, while continuous across the zero current axis, exhibit a great decrease in diffusion current and greater slopes. In general continuous anodic-cathodic waves were obtained. A unique situation occurred at the dropping copper amalgam electrode with an appropriate concentration of copper(II) ion in solution in that no diffusion current was obtained. This was explained by showing that diffusion in the amalgam to form copper(I) complex was equal to the cathodic flux for the diffusion of copper(II) in the solution. Microfilm $2.80; Xerox $9.60. 213 pages.

CHEMISTRY, ORGANIC

CYCLOPROPYL ANALOGS OF HEXESTROL AND DIETHYLSTILBESTROL

(L. C. Card No. Mic 59-2924)

James Gordy Bennett, Jr., Ph.D.
Rensselaer Polytechnic Institute, 1959

Supervisor: Stanley C. Bunce

The purpose of this research was to investigate synthetic routes for the preparation of several cyclopropyl compounds which are structurally related to hexestrol, diethylstilbestrol and estradiol, namely, 1,2-dicyclopropyl-1,2-di-p-hydroxyphenylethane, 1,2-dicyclopropyl-1,2-di-p-hydroxyphenylethylene and 1,1'-di-p-hydroxyphenylbicyclopropyl.

1,2-Dicyclopropyl-1,2-di-p-hydroxyphenylethane was successfully synthesized from cyclopropylphenylcarbinol by bromination to yield cyclopropylphenylcarbinyl bromide, coupling of this bromide to 1,2-dicyclopropyl-1,2-diphenylethane followed by nitration, reduction and diazotization. The overall yield from γ-butyrolactone was 1.1%. The reduction of cyclopropyl phenyl ketone with lithium aluminum hydride yielded cyclopropylphenylcarbinyl ether as well as cyclopropylphenylcarbinol. Nitration of cyclopropyl phenyl ketone led to the isolation of cyclopropyl m-nitrophenyl ketone.

1,2-Dicyclopropyl-1,2-di-p-anisylethylene was prepared from cyclopropanecarbonitrile by reaction with p-anisylmagnesium bromide to yield cyclopropyl p-anisyl ketone which was converted to its hydrazone and its azine. Oxidation of the hydrazone led to 1,2-dicyclopropyl-1,2-di-p-anisylethylene. No method of demethylation was devised. The overall yield from trimethylene chlorobromide was 0.5%.

The attempt to prepare 1,1'-di-p-hydroxyphenylbicyclopropyl was unsuccessful. 1-Phenylcyclopropyl phenyl ketone was converted to ethyl 3-hydroxy-3-phenyl-3-(1-phenylcyclopropyl)propionate via a Reformatsky reaction and then reduced to 1-phenyl-1-(1-phenylcyclopropyl)propane-1,3-diol. Bromination of the diol led to the isolation of two products, both in low yield and both having the same elemental analysis. Attempts to close the second cyclopropyl ring led to the isolation of a small amount of liquid material probably 1,1'-diphenylbicyclopropyl. Due to the low yields and the laborious route further investigation was not continued.

Treatment of cyclopropylphenylcarbinyl bromide with sodium amide in liquid ammonia led to the isolation of phenylmethylenecyclopropane, a new cyclopropyl compound containing an exocyclic double bond.

Samples of 1,2-dicyclopropyl-1,2-di-p-hydroxyphenylethane, 1,2-dicyclopropyl-1,2-di-p-anisylethylene and the azine of cyclopropyl p-anisyl ketone were sent to the National Institutes of Health to be tested for endocrine and antitumor activity.

Microfilm $2.00; Xerox $6.80. 142 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

I. 1,2-DIHYDRO-ENDO-DICYCLOPENTADIENE.
II. 2-OXA-1,2-DIHYDRODICYCLOPENTADIENE.
III. 2-AZA-1,2-DIHYDRODICYCLOPENTADIENE.

(L. C. Card No. Mic 59-2381)

Chicita F. Culberson, Ph.D.
Duke University, 1959

Supervisor: Pelham Wilder, Jr.

The Diels-Alder adduct of cyclopentene and cyclopentadiene is proven to be 1,2-dihydro-endo-dicyclopentadiene by an oxidative degradation and by an unequivocal synthesis. Oxidation of the olefin yields the known diacid, endo-cis-bicyclo[3.3.0]-octane-2,4-dicarboxylic acid, which is also obtained by oxidation of 9-keto-1,2-dihydro-endo-dicyclopentadiene.

1,2-Dihydro-endo-dicyclopentadiene is synthesized from the dimeric nitroso chloride of endo-dicyclopentadiene. 9-Keto-endo-dicyclopentadiene oxime is obtained from the nitroso chloride by reduction with zinc and acetic acid. Subsequent catalytic reduction yields the saturated oxime which is converted to 9-amino-1,2-dihydro-endo-dicyclopentadiene with sodium and alcohol. Methylation of the amine followed by a Hofmann degradation of the quaternary hydroxide yields the desired olefin.

In contrast to the behavior of endo-dicyclopentadiene which is known to undergo rearrangement to the less hindered exo form upon treatment with acidic reagents, it is found that 2-oxa-1,2-dihydro-endo-dicyclopentadiene yields primarily unrearranged derivatives. Addition of hydrobromic acid gives a mixture of 9-bromo-2-oxatetrahydro-endo-dicyclopentadiene and 9-bromo-2-oxatetrahydro-exo-dicyclopentadiene with the endo isomer predominating. Hydration of 2-oxa-1,2-dihydro-endo-dicyclopentadiene with sulfuric acid yields 9-hydroxy-2-oxatetrahydro-endo-dicyclopentadiene only slightly contaminated by the exo isomer. That acetic acid adds to form unrearranged acetate is confirmed. Bromination of 2-oxa-1,2-dihydro-endo-dicyclopentadiene yields a solid dibromide believed to be 9,10-exo-dibromo-2-oxatetrahydro-endo-dicyclopentadiene. A mechanism emphasizing the stabilizing effect of the oxygen in the 2-position toward reactions of 2-oxa-1,2-dihydro-endo-dicyclopentadiene with acidic reagents is proposed.

The synthesis of six derivatives of 2-oxa-1,2-dihydro-exo-dicyclopentadiene is described. Addition of hydrobromic acid and of acetic acid yield the expected 9-substituted exo derivatives.

Although less reactive toward acidic reagents than either endo-dicyclopentadiene or 2-oxa-1,2-dihydro-endo-dicyclopentadiene, it is found that 2-aza-1,2-dihydro-endo-dicyclopentadiene will add hydrobromic acid without rearrangement to the exo configuration. The mechanism proposed for reactions of 2-oxa-1,2-dihydro-endo-dicyclopentadiene with acidic reagents is applied to the addition of hydrobromic acid to 2-aza-1,2-dihydro-endo-dicyclopentadiene. The interaction between the amine nitrogen and the C^9 position required for resonance stabilization of the initial carbonium ion is proven to be sterically possible by the synthesis of a new tertiary amine having a nitrogen-C^9 bond.

A brief study of the exo and the endo isomers of N-hexyl-2-aza-1,2-dihydrodicyclopentadiene indicates that the endo isomer adds hydrobromic acid to form a bromo amine hydrobromide having the endo configuration. 2-Aza-1,2-dihydro-exo-dicyclopentadiene reacts with hydrobromic acid to yield the expected 9-bromo-2-azatetrahydro-exo-dicyclopentadiene.

Microfilm $2.00; Xerox $5.60. 112 pages.

AN INVESTIGATION OF UNSATURATED CYCLIC PHOSPHORUS COMPOUNDS: THE SYNTHESIS OF 1-PHENYL-1-PHOSPHA-CYCLOPENTADIENE-1-OXIDES

(L. C. Card No. Mic 59-641)

Robert Edmund Donadio, Ph.D.
Temple University, 1958

A new system of heterocyclic dienes, the first involving phosphorus as the only hetero atom in a monocyclic ring, has been attained in the transformation of a series of monoolefinic cyclic phosphine oxides. The Diels-Alder type condensation of conjugated dienes with aryl or alkyl phosphonous dihalides has produced a series of unsaturated 5-membered heterocyclic phosphines (McCormack, U. S. 2,663,737). The initial adduct, a 1-phenyl-1-phospha-3-cyclopentene-1,1-dihalide, with various substituents in the 2,3,4 or 5 positions, is hydrolyzed upon solution in water forming a 1-phenyl-1-phospha-3-cyclopentene-1-oxide. Butadiene, isoprene and 2,3-dimethylbutadiene-1,3 with phenylphosphonous dichloride produce, respectively, 1-phenyl-1-phospha-3-cyclopentene-1-oxide-(I), 1-phenyl-3-methyl-1-phospha-3-cyclopentene-1-oxide (II) and 1-phenyl-3,4-dimethyl-1-phospha-3-cyclopentene-1-oxide (III). These intermediates were prepared and selected for conversion to the 1-phospha-2,4-cyclopentadiene ring system. The first approach to the cyclic diene was to add bromine to compounds I, II and III to give the corresponding 3,4-dibromo derivatives which on subsequent dehydrobromination would form the diolefin.

Compound II was brominated directly by the addition of bromine to a sample of II dissolved in chloroform. Bromination proceeded slowly and it was necessary to reflux the reaction mixture for 12 hours. Excess bromine was removed and the dibromide isolated as an oil. This was dissolved in benzene to which was added slowly, while boiling the solution, twice the required quantity of triethylamine. A copious precipitate of triethylamine hydrobromide formed immediately. The solution was boiled a few minutes, filtered and concentrated to a viscous amber colored oil. The oily residue slowly crystallized. Trituration of the semi-solid material with ether produced a white solid material. This product on recrystallization from benzene and petroleum ether melted at 257^0 and was found to have a molecular weight of 395 ± 20 (M.W. of II, 192). This together with the fact that the infrared absorption spectrum showed a pronounced duplicity of all major absorption peaks indicated the product to be a dimer of the expected diene, 1-phenyl-3-methyl-1-phospha-2,4-cyclopentadiene-1-oxide.

Similarly, compound III was treated with bromine in chloroform, the dibromo derivative isolated as an oil, dissolved in benzene, triethylamine added and the solution boiled for several minutes. Removal of the triethylamine hydrobromide and concentration of the benzene solution

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

produced a deep amber oil. The ultraviolet absorption spectrum of a sample of the oily product showed a single broad maximum and minimum similar to the curves exhibited by cyclopentadiene and cyclohexadiene. Its Σmax of 5000 at 245mμ and Σmin of 4800 at 238mμ contrasts markedly with the ultraviolet spectrum of III, the parent compound. The characteristic fine structure observed for the phenylphosphoryl grouping in the spectrum of III (Σmax of 601 at 265.5mμ, its principal band) is almost completely eliminated in the dehydrobrominated product. The diene forms a dimer on standing, m.p. 252° (M.W. 401).

A more suitable method of brominating the intermediates was to combine the requisite amount of pyridinium bromide perbromide with a sample of the monoolefin in glacial acetic acid and allow the resulting solution to stand in the dark for several days. I forms 1-phenyl-3,4-dibromo-1-phosphacyclopentane-1-oxide (Ia), m.p. 139° (recrystallized from benzene and petroleum ether). II forms a dibromide isolated as a pale yellow oil. The dibromide of III, isolated as an oil which slowly crystallized, spontaneously debrominates on exposure to air.

A second route to the phosphadiene was to convert the dibromide, Ia, to its corresponding 3,4-bis-(dimethylamino) derivative by treating a benzene solution of Ia with excess dimethylamine for several days. Isolation of the aminated product as an oil followed by the addition of methyl iodide gave the 1-phenyl-1-phospha-3,4-bis-(dimethylamino)-cyclopentane-1-oxide monomethiodide (Ib) m.p. 236°. Degradation of the methiodide was accomplished by stirring its aqueous solution with a suspension of freshly precipitated silver oxide in an ice bath for ten minutes. The ultraviolet spectrum of the product 1-phenyl-1-phospha-4-dimethylamino-2-cyclopentene-1-oxide (Ic) in methylene chloride showed a two-fold increase in the number of absorption bands accompanied by an increase in intensity and refinement of fine structure. It formed a methiodide derivative which was subsequently degraded with silver oxide, as in the previous case, to give the final compound in this series, 1-phenyl-1-phospha-2,4-cyclopentadiene-1-oxide. A completely different ultraviolet absorption spectrum was observed with no resemblance to its precursors. The diene exhibits a broad band of strong intensity with a maximum at 271mμ. In addition, two bands of low intensity appear in the 340-360mμ region.

The conjugative effect has been noted in ultraviolet spectra of cyclic compounds with a double bond in the ring adjacent to phosphorus, namely, compound Ic and 1-phenyl-1-phospha-4-bromo-2-cyclopentene-1-oxide. The latter compound (m.p. 110°), obtained from Ia by the removal of one mole of HBr, exhibits a spectrum similar to that of Ic at a lower absorption intensity. Also, there is apparent double bond-phosphoryl group interaction in diethyl vinylphosphonate which was found to give an ultraviolet absorption spectrum with a broad band of strong intensity at 255mμ (Σmax 965) and one of lower intensity at 300mμ (Σmax 114). Microfilm $2.00; Xerox $5.20. 105 pages.

THE REACTIVITIES OF CARBENES

(L. C. Card No. Mic 59-2882)

Robert Miller Etter, Ph.D.
The Pennsylvania State University, 1959

The purpose of this study was to demonstrate the existence of carbenes in various reaction systems and, when present, to determine the reactivities of these intermediates. The existence of carbenes was decided on the basis of the products obtained by their reaction with olefinic double bonds, more particularly the stereospecificity of this addition to stereoisomeric olefins. The reactivities of these intermediates was elucidated by determining the reactivities of a graded series of olefins with the carbenes.

The copper catalyzed decomposition of diazoacetone gave acetylcarbene, as evidenced by the stereospecificity of its addition to stereoisomeric olefins. By analogy, it was reasoned that diazoacetophenone gave benzoylcarbene by similar decomposition.

Ethyl diazoacetate, when decomposed catalytically, gave carbethoxycarbene, as evidenced by its stereospecific addition to stereoisomeric olefins. The catalytic reaction was carried out in the presence of several different olefins, and was found to produce only cyclopropane derivatives and, in some cases, diethyl fumarate. When the decomposition was carried out thermally, similar products were obtained. However, when the reaction was carried out photolytically, both cyclopropanes and unsaturated isomeric materials were produced. This was believed due to an activation of the carbene species produced by photolytic decomposition, in analogy with other carbenes previously studied.

The reactivities of a series of olefins for the carbene species produced by the catalytic decomposition of the diazo compound was found to parallel the series reported for dibromocarbene. The reactivity series was 2,3-dimethyl-2-butene = 2-methyl-2-butene > cyclohexene > 1-hexene. This indicated that carbethoxycarbene was an electrophilic reagent. Comparison of the relative reaction constants for a given olefin with the two carbene species shows that carbethoxycarbene is a much less selective species than dibromocarbene. This lower selectivity was rationalized on the basis of the resonance stabilization of the carbene species.

Catalytic decomposition of diazomethane in the presence of cyclohexene gave carbene which reacted only with the double bond of the olefin, in contrast to carbene produced photolytically, which had been shown to react with the carbon-hydrogen bonds of olefins as well.

The catalytic decomposition of diphenyldiazomethane in the presence of olefins gave no addition to the double bond. However, photolysis of the diazo compound gave cyclopropane derivatives as well as unsaturated isomeric products. The addition to the double bonds of stereoisomeric olefins was found to be non-stereospecific. Furthermore, the reactivities of a series of olefins paralleled that expected for a free radical type intermediate. From these results it was concluded that the photolysis of diphenyldiazomethane gave a "triplet state carbene" or diphenylmethylene diradical. Microfilm $2.35; Xerox $8.20. 179 pages.

MEDIUM EFFECTS ON THE RACEMIZATION RATE OF SOME DERIVATIVES OF 2,2'-DIMETHOXY-6,6'-DICARBOXYDIPHENYL

(L. C. Card No. Mic 59-1756)

Bruce M. Graybill, Ph.D.
The Florida State University, 1959

Major Professor: John E. Leffler

Rates of racemization of an optically active biphenyl, 2,2'-dimethoxy-6,6'-dicarboxydiphenyl, its salts, dimethyl ester and diamide were measured in a variety of solvents and solvent mixtures. In general when organic solvents or salts were added to aqueous solutions of derivatives of dimethoxydiphenic acid the rate was decreased. The rate was generally faster in polar media except when specific solvent-biphenyl interactions such as hydrogen bonding were possible. The decrease in rate was usually accompanied by a lower enthalpy of activation, $\Delta H^{\ddagger}$, and a more negative entropy of activation, $\Delta S^{\ddagger}$.

All inorganic salts decreased the rate of racemization of the dianion in water. These were specific salt effects with small cations having a larger effect than large ones. Divalent cations had the greatest effect. The rate of racemization also decreased as the concentration of the biphenyl increased. Cationic detergents also had a retarding effect on the reaction. The rate seemed to be rather insensitive to changes in the anions. Variation in the strength of association or chelation between the biphenyl and the cations was invoked to explain the salt effects.

The rate of racemization of the monosodium salt was much slower than the rate of racemization of the disodium salt. The decrease in the rate caused by adding organic solvents to aqueous solutions of the dibasic salt was attributed to a shift in equilibrium to the side of the mono salt.

The rate of racemization of the free acid was faster in more polar media unless hydrogen bonding could occur. Because of this a more polar transition state, relative to the ground state, was postulated for the racemization. The transition state was assumed to be planar or nearly planar. Hence π electron interaction between the phenyl rings resulting in some charge separation should be possible. To account for the exceptions, hydrogen bonding between the carboxyl group of the biphenyl and an electronegative atom of the solvent was postulated.

The dimethyl ester also racemized faster in polar solvents than in non-polar solvents. This was explained by assuming a similar polar transition state with π electron overlap between the benzene rings. Addition of trinitrobenzene increased the rate slightly; this was attributed to the stabilization of the planar transition state through π complexing.

Studies of the diamide were limited because of its low solubility in most common solvents. However, as previously, the rate in more polar solvents was faster. The anomalies were also attributed to specific effects such as proton bonding.

None of the general solvent effect theories could predict that the rates of racemization of these biphenyl derivatives would be solvent sensitive because the theories take into account only large changes in the polar character of the reaction. It was concluded that it is impossible to predict rates accurately from only the gross macroscopic properties of solvents such as dielectric constant. Instead, it is necessary to consider the specific chemical interactions of neighboring solvent-solute molecules in addition to the gross solvent properties in order to predict more exactly the effect of solvent on reaction rates.

Microfilm $2.00; Xerox $7.00. 148 pages.

FORMATION AND CONDENSATIONS OF SOME DICARBANIONS PREPARED BY MEANS OF POTASSIUM AMIDE IN LIQUID AMMONIA

(L. C. Card No. Mic 59-2384)

Thomas Munson Harris, Ph.D.
Duke University, 1959

Supervisor: Charles R. Hauser

In contrast to the common reactions at the methylene group of benzoyl- and acetylacetone, several types of carbon-carbon condensations including alkylation, acylation, and carbonation were realized at the methyl group of these β-diketones. These reactions were effected through intermediate dipotassio salts, which were prepared by means of two equivalents of potassium amide in liquid ammonia. Mechanisms and synthetic applications are indicated.

6-Phenyl-2,4-hexanedione, 2-acetylcyclohexanone and 2-acetylcyclopentanone were treated with two molecular equivalents of potassium amide in liquid ammonia, followed by one molecular equivalent of benzyl chloride. Although each of these β-diketones could conceivably be converted into two different dicarbanions, each appeared to form only one dicarbanion, that involving the terminal methyl group, since mono-benzylation occurred exclusively at this position. The structures of the alkylation products were established by independent syntheses. The theoretical and practical implications of these results are indicated.

Both the α- and α'-hydrogens of dibenzyl ketone were ionized by means of two molecular equivalents of potassium amide in liquid ammonia to form a red dicarbanion. This dicarbanion underwent exclusive monobenzylation with one equivalent of benzyl chloride and dibenzylation, with two equivalents of this halide. It underwent almost quantitative conjugate addition to ethyl cinnamate. The monocarbanion of dibenzyl ketone gave a mixture of products with an equivalent of benzyl chloride and failed to react with ethyl cinnamate under the conditions used with the dicarbanion.

Both the α- and α'-hydrogens of dibenzyl sulfone were ionized by means of two equivalents of potassium amide in liquid ammonia to form a pale yellow dicarbanion. This dicarbanion underwent monobenzylation with one equivalent of benzyl chloride and dibenzylation, with two equivalents of this halide. The mono- and dibenzylation products underwent β-elimination reactions with excess potassium amide in ether to form stilbene. The monocarbanion of dibenzyl sulfone gave a mixture of products with an equivalent of benzyl chloride.

2,3,3-Triphenylpropionitrile was converted by one equivalent of potassium amide in liquid ammonia to the pale green monocarbanion and by two equivalents of this base, to the dark red dicarbanion. This two-fold ionization involved the α- and β-hydrogens respectively. The red dicarbanion reacted with an equivalent of benzyl chloride to give exclusively the β-benzyl derivative and with

an equivalent of benzhydryl chloride, to form apparently the β-benzhydryl derivative and an olefinic hydrocarbon. This hydrocarbon resulted presumably by the β-elimination of the cyanide ion from the monocarbanion of the α-benzhydryl derivative. The dicarbanion reacted with methylene chloride and diphenyldichloromethane to produce apparently the corresponding cyclopropane derivatives.

Microfilm $2.00; Xerox $6.00. 122 pages.

THE SYNTHESIS OF 3,4-DIMETHYLENE-7-OXABICYCLO[4.1.0]-HEPTANE AND PYROLYSIS OF CYCLIC CARBONATES

(L. C. Card No. Mic 59-1915)

Charles Emery Knox, Ph.D.
University of Maryland, 1958

Supervisor: William J. Bailey

Since the pyrolysis of acetates has been utilized successfully in syntheses of both unsubstituted and alkyl-substituted 1,2-dimethylenecyclohexanes and 1,2-dimethylene-4-cyclohexenes, the syntheses of 1,2-dimethylenecyclohexanes containing various polar substituents were of interest. The synthesis of an epoxy derivative of this diene system was of special interest since such a synthesis would not only give an indication of the stability of the oxirane ring during ester pyrolysis but also make possible the preparation of a new class of epoxy resins.

The pyrolytic elimination of acetic acid from 7-oxabicyclo-[4.1.0]-heptane-3,4-dimethanol diacetate resulted in a 14% yield of the conjugated exocyclic diene, 3,4-dimethylene-7-oxabicyclo-[4.1.0]-heptane, which was characterized not only by conversion to Diels-Alder adducts, but also by its infrared and ultraviolet spectra. Thus, 3,4-dimethylene-7-oxabicyclo-[4.1.0]-heptane was condensed with maleic anhydride to form 6,7-epoxy-$\Delta^{9\ 10}$-decaline-2,3-dicarboxylic anhydride and with 1,4-naphthoquinone to form 2,3-epoxy-1,2,3,4,5,5a,6,11,11a,12-decahydronaphthacene-6,11-dione. The presence of expected functional groups was indicated by the infrared spectrum, while the presence of conjugated diene system was indicated by the ultraviolet spectra. The action of aqueous caustic on the epoxy diene produced a small quantity of the solid trans-1,2-dimethylenecyclohexane-4,5-diol, which was characterized by its ultraviolet and infrared spectra.

Polymerization of 3,4-dimethylene-7-oxabicyclo[4.1.0]-heptane in an emulsion system gave a 37% conversion to poly-3,4-dimethylene-7-oxabicyclo-[4.1.0]-heptane, a solid polymer, which did not display a definite softening point but was modified at 180-200°, apparently by means of thermal cross-linking. Benzoyl peroxide-catalyzed polymerization of 3,4-dimethylene-7-oxabicyclo-[4.1.0]-heptane followed by cross-linking with ethylene diamine gave a hard, brittle epoxy resin.

Two derivatives of cyclohexane-1,2-dimethanol diacetate were also prepared. Chlorination of Δ^4-cyclohexene-1,2-dimethanol diacetate in glacial acetic acid gave 4-chloro-5-hydroxycyclohexane-1,2-dimethanol diacetate while reaction with performic acid, followed by complete saponification of the intermediate, gave trans-4,5-dihydroxycyclohexane-1,2-dimethanol.

A series of cyclic carbonates were prepared and their thermal stabilities were determined for use as possible blocking groups. Thus, cis-1,2-carbonyldioxycyclohexane was prepared by the action of phosgene on cis-1,2-cyclohexanediol in the presence of pyridine.

Pyrolysis of the cis-1,2-carbonyldioxycyclohexane at 500° gave an 86% recovery of the cyclic carbonate. The action of phosgene on trans-1,2-cyclohexanediol in the presence of pyridine did not lead to a cyclization to form the trans-cyclic carbonate, but yielded the monochloroformate.

Although erythritol-1,4-diacetate reacted normally with phosgene to form the cyclic carbonate, it reacted with ethyl carbonate to give erythritol dicarbonate by an ester interchange with both the hydroxyl and the acetate groups. These cyclic carbonates generally showed high thermal stability. In the glycerol series, monocarbomethoxy glycerol carbonate and glycerol carbonate were also prepared by the action of phosgene on glycerol, followed by treatment with methanol to transform the intermediate chloroformates to methyl carbonates. The glycerol carbonates did not display the high thermal stability of the other cyclic carbonates. For example, prolonged heating of monocarbomethoxy glycerol carbonate resulted in decomposition to glycerol tricarbonate.

Microfilm $2.00; Xerox $5.00. 99 pages.

A STUDY OF FREE RADICAL PROCESSES IN THE CHEMICAL SHOCK TUBE

(L. C. Card No. Mic 59-2743)

William Edward Lee, Ph.D.
The Ohio State University, 1959

A two-inch, single pulse chemical shock tube was used to study the kinetics and reaction mechanisms of a series of chemical processes at high temperatures. The thermal decomposition of azomethane, cyclopropane, and n-pentane, and the reactions of methyl radicals, cyclopropane, and n-pentane with oxygen were investigated.

The shock tube consists of a high pressure or driver section, a low pressure buffer and reaction section, and an evacuated expansion tank that is located upstream of the driver section. These three sections are separated by thin metal diaphragms.

In these experiments the gaseous reactants were subjected to a reflected shock wave and the accompanying high temperature pulse of known intensity, shape, and duration. The reaction mixture was then rapidly cooled by expansion or rarefaction waves which are formed when the diaphragm to the expansion tank is broken. Cooling rates of the order of 10^6 degrees/sec. were achieved. The processed reaction mixture was flushed from the shock tube and analyzed by gas chromatography.

Azomethane was thermally decomposed in the shock tube in the temperature range of 472 to 632°C. and at reaction times of 0.2 to 3.8 milliseconds. At low temperatures and at low concentrations, ethane and nitrogen are the only products formed. At the higher temperatures and at high initial concentrations of azomethane, methane, ethylene, propane, and hydrogen are formed. The unimolecular rate expression was found to be

$$k = 1.26 \times 10^{15} \exp^{\frac{-46,200}{RT}} (\text{sec})^{-1}$$

The values of the Arrhenius parameters are in agreement with those values obtained in conventional studies at lower temperatures. The validity of the chemical shock tube for the study of certain chemical reactions is further established.

The reaction of methyl radicals and oxygen at 502°C. resulted in the formation of formaldehyde, carbon monoxide, carbon dioxide, and hydrogen as major products and ethylene, methanol, hydrogen peroxide, and formic acid as minor products. Dimethyl peroxide, methyl hydroperoxide and performic acid were not detected. The initial reactions of methyl radicals with oxygen appear to be $CH_3 + O_2 \longrightarrow HCHO + OH$, and $CH_3 + O_2 \longrightarrow CH_3OO$. The results indicate that the reactions $2\ CH_3OO \longrightarrow 2\ CH_3O + O_2$, $2\ CH_3O \longrightarrow HCHO + CH_3OH$ and $CH_3O + RH \longrightarrow CH_3OH + R$ do not occur to a significant degree.

When cyclopropane is subjected to high temperatures in the shock tube isomerism to propylene is the dominant reaction. At high temperatures carbon, hydrogen, ethylene, methane, and other fragments are formed. Pentane is thermally decomposed to products that are generally expected of a thermal cracking reaction. When oxygen is present carbon monoxide and carbon dioxide are the dominant products and appear to be formed in this sequence. Only in rare isolated cases were traces of oxygenated organic species detected. Oxygenated products with any vestige of the original carbon skeleton are absent even at very short reaction times.

Microfilm $2.40; Xerox $8.40. 184 pages.

BASE CATALYZED DEHYDRATION AND CLEAVAGE VERSUS ACID CATALYZED DEHYDRATION OF SELECTED ALCOHOLS

(L. C. Card No. Mic 59-1918)

Daniel Anthony Lima, Ph.D.
University of Maryland, 1958

Supervisor: Ernest F. Pratt

Although base catalyzed dehydrations have found a variety of specialized applications in preparative organic chemistry, apparently no kinetic data on base catalyzed dehydrations have been published. This is in marked contrast to the extensive kinetic studies of base catalyzed dehydrohalogenations which have been reported.

In the present investigation a distillation method previously employed for following a number of acid catalyzed reactions in which water is a by-product has been adapted to the study of alkoxide catalyzed dehydrations. Constant catalyst activity was maintained by using 2-ethylhexanol as the solvent and the corresponding potassium alkoxide as the catalyst.

Eight alcohols of the $p\text{-}RC_6H_4CH_2CHOHC_6H_5$ and $C_6H_5CH_2CHOHC_6H_4R\text{-}p$ series, in which R was varied among CH_3O, CH_3, H and Cl were dehydrated smoothly; ordinarily 96 to 100% yields of water and 80 to 85% yields of the pure trans stilbenes were obtained. The plot of the logarithm of the percentage water versus time was in most cases linear over the 10 to 80% portion of the reaction demonstrating that the reaction was first order in the alcohol; upon varying the amount of alkoxide the process was found to be accurately first order in the catalyst as well.

Good straight line correlations were obtained upon plotting the logarithms of the rate constants for the $p\text{-}RC_6H_4CH_2CHOHC_6H_5$ and the $C_6H_5CH_2CHOHC_6H_4R\text{-}p$ series versus σ values for the various para substituents as developed by Hammett; the respective slopes were 2.80 and 0.365. The markedly different slopes, the correlations themselves and the first order dependence of the reaction rate on the concentrations of alcohol and catalyst are consistent with a mechanism in which the catalyst removes a proton from the methylene group in the rate controlling step and the resulting carbanion ejects an hydroxide ion with formation of an olefinic bond in subsequent rapid steps.

The fact that $(C_6H_5)_2CHCH_2OH$ dehydrated over twenty-five times as fast as $C_6H_5CH_2CH_2OH$ while $C_6H_5CH_2CH_2CHOHC_6H_5$ did not dehydrate emphasizes the importance of activation of the methylenic hydrogens by the phenyl groups.

The same $p\text{-}RC_6H_4CH_2CHOHC_6H_5$ and $C_6H_5CH_2CHOHC_6H_4R\text{-}p$ series of alcohols dehydrated smoothly using p-toluenesulfonic acid in dibutyl ether. trans Stilbenes and water were obtained in yields as high as those found with the base catalyst and the rate data again gave linear first order plots for about the 10 to 80% portion of the reaction, showing that the acid catalyzed dehydration is also first order in the alcohol. Upon increasing the concentration of p-toluenesulfonic acid it was found, as is frequently the case with aprotic solvents, that a more than proportional increase in rate resulted. Straight lines were obtained upon plotting the logarithms of the rate constants versus H. C. Brown's σ^+ values. The slopes for the $p\text{-}RC_6H_4CH_2CHOHC_6H_5$ and $C_6H_5CH_2CHOHC_6H_4R\text{-}p$ series were -0.547 and -3.86.

A mechanism in which the acid catalyst removes an hydroxide ion in the rate controlling step and the resultant carbonium ion ejects a proton to give the trans stilbene in subsequent fast steps is consistent with the foregoing results. The acid catalyzed process appears, therefore, to be almost the exact converse of the base catalyzed process. In $C_6H_5CH_2CHOHC_6H_5$ one phenyl group promotes the acid and the other the base catalyzed process.

It is noteworthy that β-phenylethanols dehydrate well with base, but not with acid while tertiary aliphatic alcohols dehydrate well with acid, but not with base.

A further sharp contrast between the two procedures was found when the dehydration of a group of seven tertiary benzylcarbinols was attempted. Although under the standard acid conditions all seven dehydrated smoothly, under the standard base conditions the benzyl group was cleaved off as toluene, usually in 60 to 75% yield. Such cleavages have only rarely been encountered previously.

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THE SYNTHESIS OF SOME PURINE AND PYRIMIDINE DERIVATIVES AS POTENTIAL ANTIMETABOLITES AND CYTOTOXIC AGENTS

(L. C. Card No. Mic 59-2246)

Hsi Hu Lin, Ph.D.
University of Pennsylvania, 1959

Supervisor: Professor Charles C. Price

A series of 9-[2-(diethylamino)-ethyl]-6-substituted-purine derivatives were synthesized as potential antimetabolites. 4-[2-(Diethylamino)-ethyl]-5-amino-6-chloropyrimidine, prepared by treatment of 4,6-dichloro-5-aminopyrimidine with N,N-diethylethylenediamine, was cyclized with formic acid to yield the 9-[2-(diethylamino)-ethyl]-hypoxanthine. The parent compound 9-[2-(diethylamino)-ethyl]-6-chloropurine was obtained by chlorinating the corresponding hypoxanthine with phosphorus oxychloride. 9-[2-(Diethylamino)-ethyl]-purine was obtained by the catalytic reduction of the parent compound. By direct treatment of nucleophilic reagents such as ammonium hydroxide, methylamine, ethylamine, hydrazine, benzylamine, furfurylamine, thiourea and N,N-diethylethylenediamine with the parent compound, the corresponding 9-[2-(diethylamino)-ethyl]-6-substituted purine derivatives were obtained respectively.

6-Substituted-purine nitrogen mustards and 9-substituted nitrogen mustards of vital purine metabolites such as adenine and hypoxanthine were synthesized in the hope that the antimitotic activity of the purine nitrogen mustards would function more selectively in certain area of the cancerous cell, thus enhancing the chemotherapeutic value of these cytotoxic agents in the treatment of various types of tumors.

4-{3-[Bis(2-hydroxyethyl)amino]-propylamino}-5-amino-6-chloropyrimidine, prepared by condensation of 3-[bis(2-hydroxyethyl)amino]-propylamine with 4,6-dichloro-5-aminopyrimidine, was cyclized with formic acid and ethyl orthoformate to yield 9-{3-[bis(2-hydroxyethyl)amino]-propyl}-hypoxanthine and 9-{3-[bis(2-hydroxyethyl) amino]-propyl}-6-chloropurine. The amination of the chloropurine diol with ammonium hydroxide yielded the corresponding adenine diol. The chlorination of the diaminochloropyrimidine, hypoxanthine and adenine diols with thionyl chloride yielded the corresponding nitrogen mustard respectively.

The direct treatment of 6-chloropurine with 3-[bis(2-hydroxyethyl)amino]-propylamine and 2-[bis(2-hydroxyethyl)amino]-ethylamine yielded 6-{3-[bis(2-hydroxyethyl)-amino]-propylamino}-purine and 6-{3-[bis(2-hydroxyethyl)-amino]-ethylamino}-purine. The chlorination of the two purine diols with thionyl chloride yielded the corresponding mustards respectively.

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I. HETEROGENEITY AS A FACTOR IN THE ALKYLATION OF AMBIDENT ANIONS: PHENOXIDE IONS. II. THE ALKYLATION OF AMBIDENT ANIONS: PHENOXIDE IONS.

(L. C. Card No. Mic 58-3173)

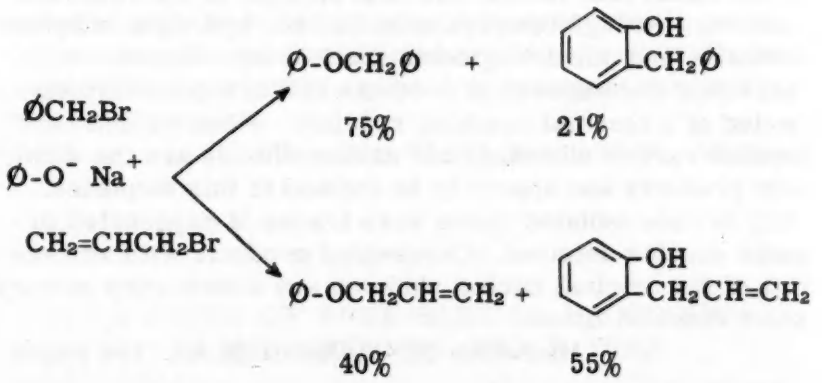
Arnold Paul Lurie, Ph.D.
Purdue University, 1958

Major Professor: Nathan Kornblum

PART I

Lithium, sodium and potassium salts of phenol and p-tert-octylphenol have been alkylated with a number of benzylic and allylic halides, in a variety of solvents. In all cases carbon-alkylation is achieved only when the phenolic salt is present as a solid phase; reactions conducted in solution give a quantitative yield of the oxygen-alkylated product.

Thus, in ethyl ether (heterogeneously)



In contrast, the homogeneous reactions in ethylene glycol dimethyl ether give 98% and 99% yields of benzyl phenyl ether and allyl phenyl ether, respectively.

The possibility that this difference derives from specific solvation by one of these ethereal solvents is ruled out by experiments employing sodium p-tert-octylphenoxide which is readily soluble both in ethyl ether and in ethylene glycol dimethyl ether. With benzyl bromide, or allyl bromide, reactions conducted homogeneously in either solvent result exclusively in O-alkylation (98-99% yields). The corresponding potassium salt is only slightly soluble in ethyl ether and is found to give rise to 19-21% C-alkylation with benzyl bromide or allyl bromide; it is completely soluble in ethylene glycol dimethyl ether in which 96-97% O-alkylation occurs.

Another demonstration of the importance of heterogeneity is provided by experiments utilizing a single solvent. Potassium p-tert-octylphenoxide suspended in 100 ml. of toluene reacts with benzyl chloride to give 81% O- and 14% C-alkylation. However, when the same amount of potassium salt is dissolved in 3.5 liters of toluene and treated with benzyl chloride a 99% yield of the O-alkylated compound is obtained; no trace of the C-alkylated product is detected. The difference is even more striking when it is realized that in the course of the "heterogeneous" process the mixture becomes completely homogeneous at ca 60% completion. Presumably, then, whatever C-alkylation occurs must arise during that portion of the "heterogeneous" process in which the phenolic salt reacts in the solid phase. That this, indeed, is the case was demonstrated by the increasing C- to O-alkylation produced as the reaction was stopped closer

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ard closer to 1% reaction. This same sequence was observed with allyl chloride as the alkylating agent.

According to the ambident anion theory (1) the greater the carbonium character of the transition state the greater is the preference for bond formation with the atom of higher electronegativity and, conversely, the greater the S_N2 contribution to the transition state the greater is the preference for covalency formation with the atom of lower electronegativity. However, the phenoxide ion which by definition is an ambident anion gives rise to just the reversed trend. That is, in the alkylation of lithium, sodium and potassium phenoxide with various para-substituted benzyl halides, heterogeneously, the amount of C-alkylation changed in the following order: $-OCH_3 > -CH_3 > +H > -Br > -NO_2$.

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Microfilm $4.90; Xerox $16.40. 383 pages.

SALTS AND ESTERS OF AMINO CARBOHYDRATES

(L. C. Card No. Mic 59-2561)

George Garrison Maher, Ph.D.
The Ohio State University, 1954

Chitin, the skeletal structure component of crustacea and other forms of lower life, principally the former, has been known since 1823. It has been subjected to acid hydrolytic degradation studies, enzymic hydrolytic degradation studies, and characterization of the monomeric and oligosaccharide hydrolyzate components; its general character as a polymer has also been elucidated.[1,2,3,4] By comparison with similar studies on cellulose, whose general structure has been essentially established, it is believed that chitin is a polymer of 1⟶4 glycosidically-linked 2-acetamido-2-deoxy-D-glucopyranose units. It must be pointed out that a rigorous establishment is lacking, chiefly in that the pyranose ring structure has not been firmly shown in D-glucosamine or in chitin. One of the interesting reactions of chitin is that the acetyl groups may be partially removed by the action of alkali, yielding a substance called chitosan. The extent of deacetylation varies with the severity of the treatment.[5] Chitosan is a typical heterofunctional polymer containing amino groups, hydroxyl groups, and acetamido groups. While some studies have been made on the basic character of the amino groups in forming salts, the behavior of the functional groups in typical derivatization reactions has been but little explored. Weinstein has acetylated chitosan;[6] and Wolfrom, Shen, and Summers have made N- and O-sulfated derivatives.[7]

A quantity of partially deacetylated chitin, which had been prepared by the method of Rigby,[5] was at hand.[8] The material obtained was in the form of light-tan, thin, brittle flakes smaller in size than the common wheat-flake breakfast food cereal. Analysis by the modified Freudenberg method[9] showed the presence of 0.15 acetyl group per anhydro-D-glucosamine unit. The deacetylated chitin (chitosan) was soluble in dilute acids and could be precipitated therefrom by neutralizing the solution with base. Evaporation of solvent from dilute acid solutions left clear, tough, pliable films.

Extraction of 38 g. of the flake chitosan with 8 to 10 per cent aqueous acetic acid, then with 50 per cent acetic acid, each for 24 hr., yielded extracts I and II. These were neutralized with base to obtain products I and II, which were washed with water, then alcohol, then ether, and dried under reduced pressure. Product I, yield 28.5 g., contained 0.15 N-acetyl group per anhydro-D-glucosamine unit. Product II, yield 2.0 g., was not analyzed. Neutralization of the final extraction residue as a water suspension gave product III, yield 2.0 g., which contained 0.15 N-acetyl group per anhydro-D-glucosamine unit.

The purified chitosan (product I) formed the perchlorate salt in 94 to 99 per cent yield upon heterogeneous reaction at 5-8°C. with perchloric acid under varied solvent conditions: (1) in a dioxane medium (25 ml. per g. of chitosan) containing a 2 to 3 per cent excess of perchloric acid over that theoretically needed, added as 61.1 per cent aqueous perchloric acid, hence introducing an amount of water equal to 1.5 per cent of the entire system by weight (repeated treatment of the product did not alter the character of the product); (2) in the presence of a 2 per cent excess of perchloric acid in an aceteous perchloric acid medium (16.6 ml. per g. of chitosan), made by mixing 1.54 g. of 61.1 per cent aqueous perchloric acid and 3.2 g. of acetic anhydride in enough glacial acetic acid to give a total volume of 26.6 ml.; (3) in the presence of a 22-fold excess of perchloric acid in a mixture of perchloric acid and glacial acetic acid (82.5 ml. per g. of chitosan), made by mixing 33 ml. of 61.1 per cent aqueous perchloric acid and 132 ml. of glacial acetic acid, hence introducing an amount of water equal to about 10 per cent by weight of the system. The residual solid salts were purified by washing with anhydrous ether in the case of (1) and with several portions of glacial acetic acid and then with ether in (2) and (3) until ether washes were neutral to litmus paper. The residues were dried under reduced pressure. The water-soluble products were determined to be the perchlorate salt of 85 per cent deacetylated chitin with 0.85 mole of perchloric acid and 0.15 N-acetyl group per anhydro-D-glucosamine unit. The foregoing preparative techniques were patterned after the method of Hofmann, Metzler, and Hobald for making amine perchlorates[10] and the analytical use of perchloric acid in determining amines.[11] An infrared absorption spectrum of the salt

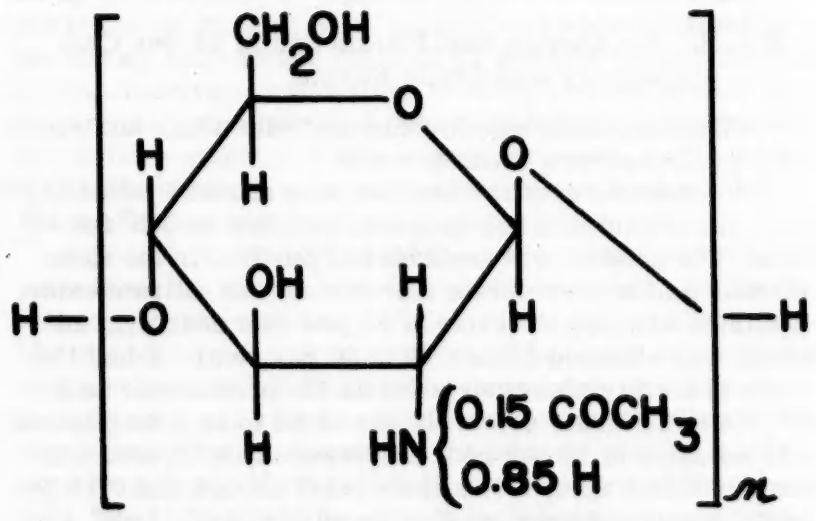


Fig. 1. 85 Per Cent Deacetylated Chitin.

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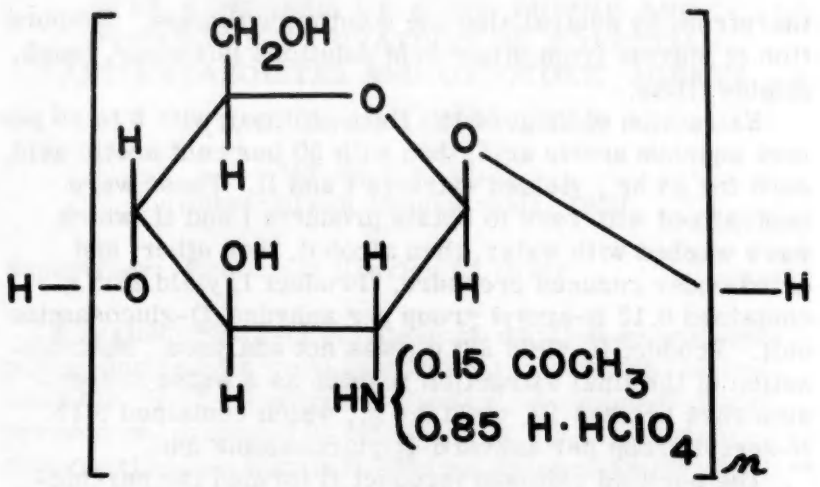


Fig. 2. Perchlorate Salt of 85 Per Cent Deacetylated Chitin.

showed absorption bands at 3.0 microns due to O-H and N-H bonds, at 6.1 due to acetyl groups, at 6.5 due to N-H or C-N bonds, and a broad dip from about 8.5 to 10.5 due to the perchlorate salt function. See Figs. 1 and 2.

The perchlorate salt was treated with 100 per cent nitric acid (60 ml. per g. of salt) at 0-5° for 30 to 40 min. The homogeneous post-nitration mixture was drowned in 3 to 4 vol. of cold glacial acetic acid. The precipitate was isolated and purified by acetic acid and ether washes as before (yield 50 per cent). The final product was insoluble in water or acetone alone, but was soluble in 1:1 acetone: water mixtures. It was found to be a perchlorate salt-nitrate salt-nitrate ester of 85 per cent deacetylated chitin with 0.50 mole of perchloric acid, 0.35 mole of nitric acid, 1.55 nitrate ester groups, and 0.15 N-acetyl group per anhydro-D-glucosamine unit (see Fig. 3).

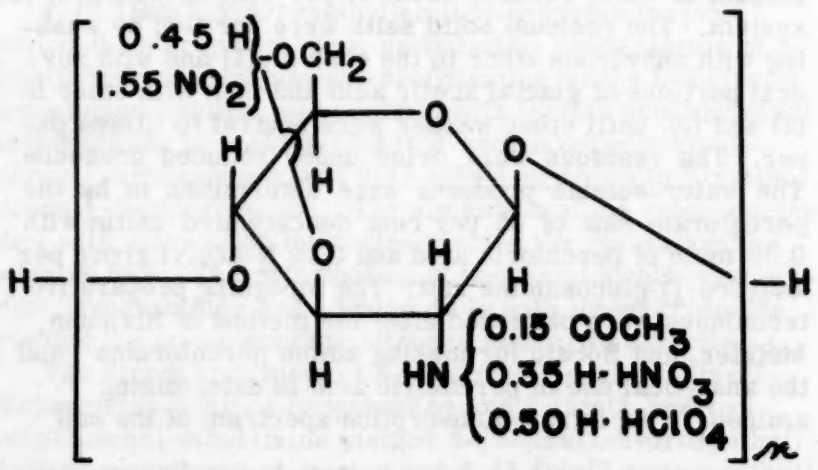


Fig. 3. Perchlorate Salt-Nitrate Salt of 85 Per Cent Deacetylated Chitin Nitrate.

Nitrations of the perchlorate salt with nitric and acetic acid mixtures were heterogeneous.

The flake form of the chitosan was nitrated with 100 per cent nitric acid in a homogeneous reaction at 0-5° for 40 min. The product was isolated and purified in the same manner as the perchlorate salt-nitrate salt-nitrate ester. A nitrate salt-nitrate ester of 85 per cent deacetylated chitin was obtained (yields 70 to 80 per cent). It had the same solubility characteristics as the perchlorate salt-nitrate salt-nitrate ester. It was found to be a nitrate salt-nitrate ester of 85 per cent deacetylated chitin with 0.85 mole of nitric acid, 1.65 nitrate ester groups and 0.15 N-acetyl group per anhydro-D-glucosamine unit. $[\alpha]_D^{23}$ + 43.3 (c 1, acetone:water, 1:1). See Fig. 4. Drowning the

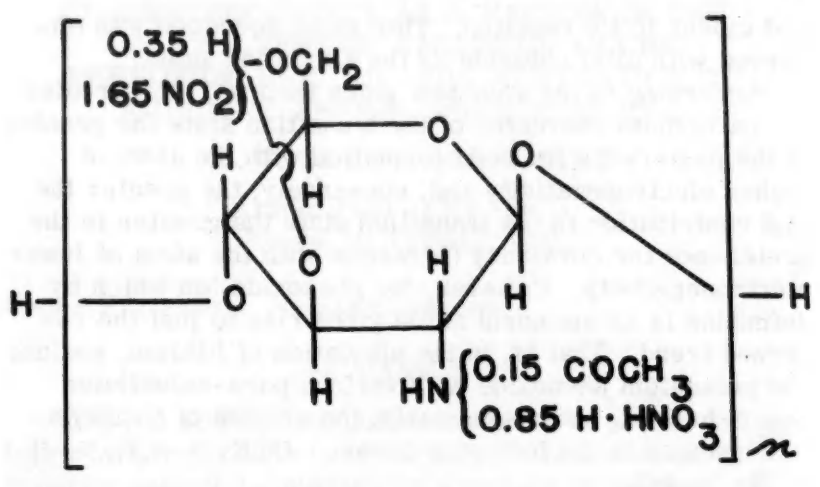


Fig. 4. Nitrate Salt of 85 Per Cent Deacetylated Chitin Nitrate.

post-nitration mixtures in dioxane produced the same nitrate salt-nitrate ester product, drowning in water yielded only small amounts of solids, and drowning in chloroform yielded nothing. An infrared absorption spectrum showed absorption bands at 3.0 microns due to O-H and N-H bonds, at 6.0, 7.8, and 12 due to nitrate ester groups, and at 6.5 due to N-H or C-N bonds. The degree of nitration, 1.65 ester groups per anhydro unit, is only 0.1 above the average for the perchlorate salt-nitrate salt-nitrate ester and equals the highest attained for the latter at an equal nitration time of 30 min.

Acetone:water solutions of the nitrate salt:nitrate ester were neutralized with dilute alkali to obtain the nitrate ester as a precipitate. The precipitate was washed well with water, then with alcohol, and finally with ether (4 to 5 times with each) to obtain a dry product in a yield of 80 per cent. It was acetone insoluble, although it swelled somewhat. It was found to be 85 per cent deacetylated chitin nitrate ester with 1.65 nitrate ester groups and 0.15 N-acetyl group per anhydro-D-glucosamine unit. See Fig. 5.

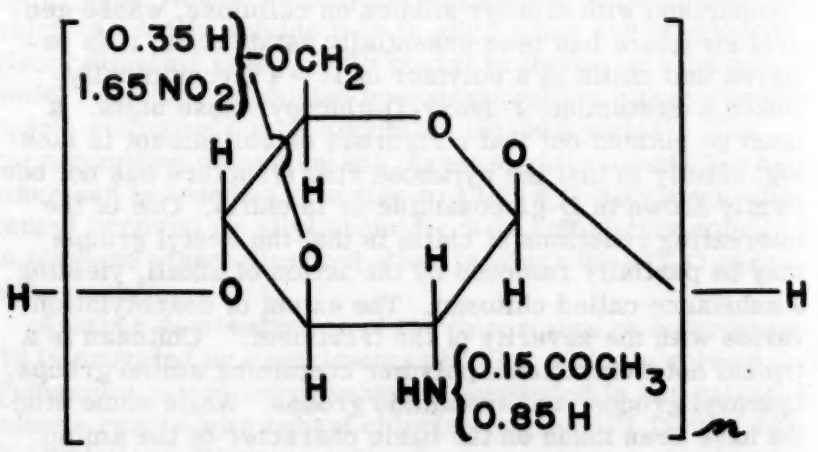


Fig. 5. 85 Per Cent Deacetylated Chitin Nitrate.

The perchlorate salt-nitrate ester of 85 per cent deacetylated chitin was prepared by treating the nitrate ester with a 2 to 3 per cent excess of perchloric acid in aceteous medium (10.7 ml. per g. of ester) as in the preparation of the perchlorate salt of 85 per cent deacetylated chitin. The reaction was heterogeneous. The solid residue was washed several times with glacial acetic acid and then was dissolved in 10 ml. of absolute ethanol (commercial). It was reprecipitated by pouring the solution into 100 ml. of ether. After washing the isolated solid about 8 times with ether and drying under reduced pressure, the yields were about

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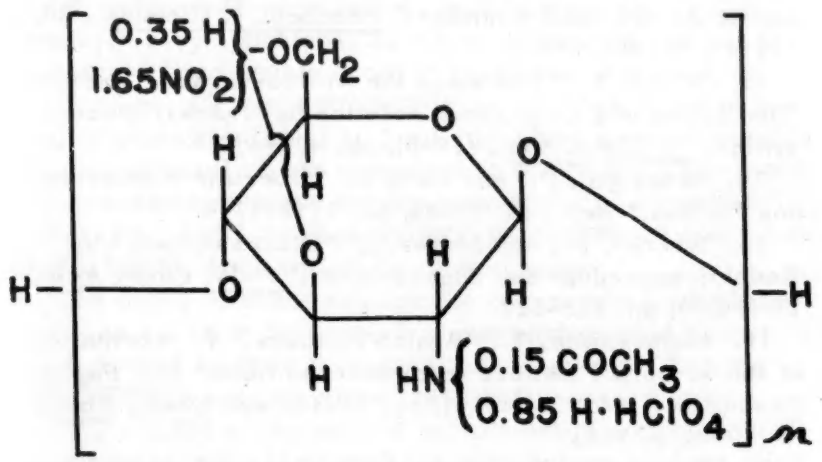


Fig. 6. Perchlorate Salt of 85 Per Cent Deacetylated Chitin Nitrate.

60 per cent (the loss being due mainly to the solubility in alcohol). The product was insoluble in water or acetone but was soluble in 1:1 mixtures thereof. It was found to be the perchlorate salt of 85 per cent deacetylated chitin nitrate with 0.85 mole of perchloric acid, 1.65 nitrate ester groups, and 0.15 N-acetyl group per anhydro-D-glucosamine unit (see Fig. 6).

The nitrate ester also reacted with aceteous chromic acid (prepared by adding 1.54 g. of 53.3 per cent aqueous chromic acid and 4.08 g. of acetic anhydride to enough glacial acetic acid to make 25 ml. vol.), employing 13.5 ml. per g. of ester at 25°. The reaction was heterogeneous. The product was washed with glacial acetic acid until the washes were water-white, then with ether until the washings were neutral. After drying under reduced pressure, the material had a light green hue; was insoluble in acetone, water, or mixtures thereof, chloroform, ethanol, or ethanol and ether; and yielded 1.37 g. The product contained less chromium and nitrate nitrogen (1.1 and 1.4 percentage points respectively) than calculated for a chromate salt-nitrate ester of 85 per cent deacetylated chitin with 0.43 mole of chromic acid, 1.65 nitrate ester groups, and 0.15 N-acetyl group per anhydro-D-glucosamine unit. The factor which makes the determined values low has not been determined. Titrations of suspensions gave indefinite acidity values.

Attempts to prepare a perchlorate salt-nitrate ester by treating 85 per cent deacetylated chitin with a ternary mixed acid of 60 per cent perchloric acid, glacial acetic acid, and 100 per cent nitric acid were unsuccessful, less than 1 nitrate ester group being introduced per anhydro unit. When the nitrate salt-nitrate ester was treated with a mixture of 60 per cent perchloric acid and glacial acetic acid, the product was similar. The action of nitrogen pentoxide (with traces of nitrogen tetroxide) in chloroform at -15 to 25° led to indefinitely characterized products of about 11.9 per cent nitrate nitrogen content which showed acidity and which, unlike the nitrate salt-nitrate ester, turned pink in the presence of water. The infrared spectrum showed the nitrate ester absorption bands, but not the N-H or C-N absorption band, at 6.5 microns. In this latter respect it resembled the absorption spectrum of the product resulting from the treatment of N-methyl-D-gluconamide with nitrogen pentoxide in chloroform, but differed from the spectrum of the 100 per cent nitric acid nitration product of the same amide. This may indicate the formation of some degraded product by the oxidative removal of amino and acetamido groups.

The application of the Morgan-Elson color test (p-dimethylaminobenzaldehyde in acid solution), which is purported to be a test for oxazoline rings,[12,13] to chitosan gave a negative indication. Chitin itself is nitrated to 75 per cent of the theoretically possible extent by fuming nitric acid.[14] These facts are interpreted as showing that steric hindrances do not account for the incomplete nitration with 100 per cent nitric acid. The nitrating power of the 100 per cent nitric acid probably has a limiting effect, and in this regard it was found that alginic acid, a polymer of anhydro-D-mannuronic acid units, which is difficult to nitrate with mixed acids, was nitrated to form 1.7 to 1.8 out of a possible 2 nitrate ester groups per anhydro unit quite readily by 100 per cent nitric acid at 0-5°.

The perchlorate salt of 85 per cent deacetylated chitin, dried and stored in sealed vials in a dark cabinet at room temperature, showed no visual sign of decomposition in several years. The nitrate salt-nitrate ester required nearly a year to decolorize suspended strips of ethyl violet indicator test paper. Advanced stages of decomposition were shown in 23 months. The nitrogen pentoxide nitration product required up to eight months to appreciably decolorize test paper. The nitrate ester seemed comparable to the foregoing materials. The perchlorate salt-nitrate salt-nitrate ester decolorized test paper in 1 to 2 weeks and decomposed to sirupy materials in 1 to 3 months. The perchlorate salt-nitrate ester decomposed completely to carbonaceous residues in 2 to 3 weeks and even detonated while being dried if the ethanol dissolution step was omitted in the preparation process. The chromate salt-nitrate ester seemed equal to the nitrate ester and nitrate salt-nitrate ester.

Ninety-seven per cent deacetylated chitin was made by treating purified 85 per cent deacetylated chitin (product I) with 40 per cent aqueous sodium hydroxide for 1 hr. at 80-90° in a nitrogen atmosphere. It was found to contain 0.03 N-acetyl group per anhydro-D-glucosamine unit.

When 97 per cent deacetylated chitin was treated with aceteous perchloric acid, as in the preparation of the perchlorate salt of 85 per cent deacetylated chitin, a perchlorate salt was obtained. It was unaltered by a repeated treatment and was water-soluble. It was found to be the perchlorate salt of 97 per cent deacetylated chitin with 0.97 mole of perchloric acid and 0.03 N-acetyl group per anhydro-D-glucosamine unit.

On nitration with 100 per cent nitric acid the 97 per cent deacetylated chitin behaved as 85 per cent deacetylated chitin did and gave a 76 per cent yield of a nitrate salt-nitrate ester similar in its properties to preparations of the nitrate salt-nitrate ester of 85 per cent deacetylated chitin. However, it was found to contain more nitrate nitrogen and less nitric acid than calculated for the nitrate salt-nitrate ester of 97 per cent deacetylated chitin with 0.97 mole of nitric acid, 1.65 nitrate ester groups, and 0.03 N-acetyl group per anhydro-D-glucosamine unit.

Removal of the nitric acid from the nitrate salt-nitrate ester gave the nitrate ester (yield 93 per cent). Unlike the ester of 85 per cent deacetylated chitin, this one was soluble in acetone. It was found to be 97 per cent deacetylated chitin nitrate with 1.75 nitrate ester groups and 0.03 N-acetyl group per anhydro-D-glucosamine unit. The higher degree of nitration attained in the product may be due to activation in the purification or deacetylation of the 85 per cent deacetylated chitin. However, anomolies were shown in the non-correlating experimental acid contents of the

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perchlorate salt and the nitrate salt-nitrate ester of the 97 per cent deacetylated material. It may be that the alkali treatment of the 85 per cent deacetylated material resulted in substitution of hydroxyl groups for some amino groups.

2-Amino-2-deoxy-D-glucitol hydrochloride was prepared by the method of Karrer and Meyer[15] and Matsushima.[16] Following the general nitration technique of Filbert,[17] one-half gram of the hydrochloride was nitrated with 10 ml. of 100 per cent nitric acid and 10 ml. of acetic anhydride at 0-5° for 30 min. The post-nitration mixture was drowned in water and the resulting precipitate was washed several times with saturated sodium bicarbonate solution and then with water before drying in a desiccator. It was soluble in ether and was insoluble in alcohol or petroleum ether. The crude nitrate (yield 80 per cent) was recrystallized by dissolving in 25 ml. of ether, treating with decolorizing carbon, evaporating the filtrate to 10 ml., cooling to 5°, and seeding with the crystals which had separated at the fringe of the solution. The yield of fine needles was 0.37 g., m.p. 101-102°. It was found to be 2-amino-2-deoxy-D-glucitol pentanitrate. The addition of petroleum ether to the cold ether solution to the cloud point would also reprecipitate the needles on further cooling. It is thus demonstrated that the presence of excess nitric acid prevents the acetic anhydride from forming N-acetyl groups. Microfilm $2.00; Xerox $6.60. 136 pages.

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THE CATALYTIC HYDROGENATION OF ALKENYLNAPHTHALENES

(L. C. Card No. Mic 59-2701)

Roger Huntington Mann, Ph.D.
University of Oregon, 1959

Adviser: LeRoy H. Klemm

A kinetic investigation was made on the influence of steric and electronic factors on the rate of catalytic hydrogenation of some alkenylnaphthalenes. The low pressure hydrogenations were carried out in acetic or propionic acid with Adams' catalyst. A constant volume apparatus was used and the course of the reaction was followed by the change in pressure. The apparatus, designed and constructed in this laboratory for the work, consisted of a glass cell, with a special magnetic stirring device, attached through glass tubing to an all-glass mercury manometer and in such a manner that the reacting solution and hydrogen were surrounded by water from a constant temperature bath.

In general, two reactions were found to occur simultaneously, viz. the reduction of the alkenic double bond and a much slower reduction of the naphthalene nucleus. In each case the rate of hydrogenation was found to be first order in hydrogen pressure (an initial pressure of 2 atmospheres was used). First order rate constants (k_a for the alkenic double bond, k_b for the naphthalene nucleus) were determined graphically from the composite curves obtained by plotting log p_o/p vs. time.

The average values of k_a at 29.9 ± 0.1°C. in ml./min., reproducible in most cases to 5%, were as follows: For compounds containing a trisubstituted double bond, in propionic acid--2-(2-naphthyl)-1-cyclopentene, 20; 2-(2-naphthyl)-1-cyclohexene, 18; 2-(1-naphthyl)-1-cyclopentene, 18; 2-(2-naphthyl)-1-cycloheptene, 17; 3-methyl-2-(2-naphthyl)-1-cyclohexene, 13; and in acetic acid--2-(2-naphthyl)-1-cyclopentene, 15; 2-(2-naphthyl)-1-cyclohexene, 13; 2-(1-naphthyl)-1-cyclopentene, 12; 2-(1-naphthyl)-1-cyclohexene, 8; 2-(1-naphthyl)-1-cycloheptene, 6. For compounds containing a disubstituted double bond in

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acetic acid--3-(1-naphthyl)-1-cyclohexene, 24; 3-(2-naphthyl)-1-cyclopentene, 21. For compounds containing a monosubstituted double bond, in propionic acid--1-vinylnaphthalene, 45; 2-vinylnaphthalene, 38. The value of k_b was, in general, about 1 to 2 ml./min. and was not found to vary significantly from compound to compound. The single rate constants obtained for the reduction of 1-cyclohexylnaphthalene and 1-cyclopentylnaphthalene, which contain no double bonds, were within this latter range.

The order of reactivity for the compounds studied, as based on k_a, falls in the series, monosubstituted alkenes > disubstituted alkenes > trisubstituted alkenes. For the trisubstituted alkenes alone, reactivity appears to be closely related to the ease of attainment of coplanarity of the alkenic double bond with the naphthalene nucleus. However, steric factors are not of prime importance in determining the relative ease of hydrogenation of the disubstituted and monosubstituted alkenes respectively. Here the differences in k_a between the α- and β-naphthyl compounds may be correlated directly with the difference in the larger free valence of the α-position (as compared to the β-position) of naphthalene.

From rate measurements at temperatures ranging from 5° to 40°C. in propionic acid and 20° to 40°C. in acetic acid, Arrhenius activation energies were determined. The values varied from about 4 to 8 kcal./mole. The 95% confidence intervals calculated for these values were usually large enough to include all of the values reported. Therefore the variations in activation energy were not considered to be significant.

A mechanism, consistent with the experimental results, is proposed for the steps involved in the hydrogenation process. Microfilm $2.00; Xerox $5.40. 110 pages.

THE SYNTHESES AND PROPERTIES OF n-OCTANE-d_{18} AND 2,2,4-TRIMETHYLPENTANE-d_{18}

(L. C. Card No. Mic 59-2900)

J. William Marr, Ph.D
The Pennsylvania State University, 1959

To study the effect of mass on liquid properties of hydrocarbons a method was developed for the synthesis of molar quantities of highly deuterated, high-purity hydrocarbons. Deuterated hydrocarbons can be used to study the isolated effect of mass as the geometry of a hydrocarbon molecule remains essentially the same upon replacement of hydrogen by deuterium. These deuterocarbons were synthesized in a flow system by a catalytic exchange reaction between deuterium and the corresponding hydrocarbon, deuterium being synthesized as needed by a catalytic exchange of hydrogen with heavy water. By this process any liquid hydrocarbon having a vapor pressure between two and one hundred mm. Hg at ambient temperatures and which contains no structure reactive with hydrogen on a catalyst surface can be deuterated in mole quantities to a deuterium content of more than 99 per cent.

Various catalysts were tested for suitability for deuterium exchange of hydrocarbons. Nickel on kieselguhr was used as it catalyzed a rapid exchange reaction at a temperature range 123-128° with no detectable changes in the physical properties of the hydrocarbon due to cracking or isomerization.

Approximately one mole of n-octane having a deuterium content of 99.1 per cent was synthesized using the nickel on kieselguhr catalyst at a temperature of 123-128°.

An attempt was made to synthesize 2,2,4-trimethylpentane-d_{18} using the same reaction conditions. The equilibration of 2,2,4-trimethylpentane with deuterium was extremely slow, probably as equilibration with deuterium of hydrogen from a hydrocarbon on a catalyst surface can not take place past a quarternary carbon atom.

A high-purity sample of 2,2,4-trimethylpentane containing 97.4 per cent deuterium was prepared using the nickel on kieselguhr catalyst at a temperature of 154-164°. A certain amount of both cracking and isomerization took place using the above conditions. However, as 2,2,4-trimethylpentane boils lower than its isomers and higher than any products of its cracking, purification was possible by fractional distillation. The extent of the purification was determined by vapor phase chromatography.

The following physical properties were determined for the two deuterated hydrocarbons: viscosities and densities at 0°, 20°, 37.8° and 60°, refractive indices at 20°, 40° and 60°, and infrared spectra. The following properties were calculated for the new deuterocarbons: absolute viscosities, constants A, B and C for the Antoine equation, instantaneous fractional change of viscosity with temperature at 20° and 60°, molar and specific refractions at 20°, and molar volumes at 0°, 20°, 37.8° and 60°.

From the examination of the data obtained on the above deuterocarbons together with data on benzene-d_6 and cyclohexane-d_{12} previously prepared in the Laboratory, the following conclusions were reached:

1. The molar volume of a liquid hydrocarbon at 20° decreases approximately 0.25% upon replacement of hydrogen by deuterium.

2. The molar volume of a deuterocarbon increases faster with temperature than the molar volume of the corresponding hydrocarbon.

3. The ratio of rate of change of density with temperature of a deuterocarbon to that of the corresponding hydrocarbon is proportional to the ratio of their masses between 0° and 20°, but increases with an increase of temperature.

4. The ratio of absolute viscosity of a saturated deuterocarbon to the corresponding hydrocarbon varies approximately as the square root of their masses. This ratio is temperature dependent and the extent of temperature dependence is dependent on structure.

5. Both the rate of change of viscosity with temperature and the fractional change of viscosity with temperature are sensitive to isotope replacement.

6. The refractive index of a hydrocarbon decreases upon replacement of hydrogen by deuterium. The molar and specific refractions decrease correspondingly.

Microfilm $2.00; Xerox $6.20. 127 pages.

THE SYNTHESES AND PROPERTIES OF SOME HIGH MOLECULAR WEIGHT ALKYLNAPHTHALENES, ALKYLTETRALINS AND ALKYLDECALINS

(L. C. Card No. Mic 59-2905)

Joseph Anthony Mountain, Ph.D.
The Pennsylvania State University, 1959

The object of this research was the preparation of alkylnaphthalenes, alkyltetralins and alkyldecalins and the acquisition of precise physical data on these compounds. The effects of varying the size, number and position of n-alkyl groups on naphthalenes, tetralins and decalins were determined.

Eleven high molecular weight hydrocarbons, seven of them previously unknown, were synthesized and purified. These compounds are:

PSU No.	Name
593	2-(ar)-n-decyltetralin
594	2-n-decyldecalin
606	2-n-butylnaphthalene
592	2-(ar)-n-butyltetralin
607	2-n-butyldecalin
610	7-n-butyl-1-n-hexylnaphthalene
611	7-(ar)-n-butyl-1-n-hexyltetralin
612	7-n-butyl-1-n-hexyldecalin
613	2-n-butyl-3-n-hexylnaphthalene
614	2-(ar)-n-butyl-3-(ar)-n-hexyltetralin
615	2-n-butyl-3-n-hexyldecalin

The experimental details for the synthesis of each of these hydrocarbons are given in the thesis. Of particular note is the novel one-step synthesis of 2-n-butylnaphthalene from 2-(ar)-n-butanoyltetralin.

The following properties were determined for each of the hydrocarbons: densities and viscosities at 32°, 68°, 100°, 140°, and 210°F.; boiling points at 0.50, 1.00, 2.00, 5.00, and 10.00 mm. pressure; furfural and aniline points and refractive indices at 20°, 30°, and 40°C.

The following properties were calculated for these hydrocarbons: absolute viscosities; the fractional change of centipoise viscosity with temperature $\left(\frac{1}{\eta}\frac{d\eta}{dt}\right)$ at 100° and 210°F.; kinematic viscosity index; ASTM slope; the constants (A, B and C) for an Antoine-type equation expressing the rate of change of viscosity with temperature $\left(\log\eta = A - \frac{B}{C + T}\right)$; heat of vaporization and the specific and molecular refractions.

The physical properties of the hydrocarbons listed above were examined for correlation with structure. The conclusions drawn are summarized below.

In all three series (i.e., naphthalenes, tetralins, and decalins) a transition of an alkyl group from the beta (2-) position to the alpha (1-) position results in an increase in viscosity, a decrease in VTR, an increase in density, an increase in refraction, and little change in boiling point. The transition from a n-alkyl compound to a di-n-alkyl compound of the same molecular weight results in an increase in viscosity, a decrease in VTR, an increase in density, an increase in refraction, and a decrease in boiling point. The changes noted in going from monoalkyl to dialkyl compounds are much larger than those noted in changing the position of the monoalkyl group. In all cases the vicinal dialkyl compounds show the largest changes in physical properties from the monoalkyl compounds.

Hydrogenation of alkylnaphthalenes produces a decrease in density, a decrease in refraction, and a decrease in boiling point. Hydrogenation of 1-n-alkylnaphthalenes results in a decrease in viscosity and an increase in VTR. Hydrogenation of 2-n-alkylnaphthalenes and dialkylnaphthalenes results in an increase in viscosity and a decrease in VTR.

The expansion of an alkylindan or hydrindan to an alkyltetralin or decalin of the same molecular weight results in an increase in viscosity, a decrease in VTR, an increase in density, and little change in boiling point.

Microfilm $2.00; Xerox $7.20. 152 pages.

PREPARATION OF COMPOUNDS OF POTENTIAL PHYSIOLOGICAL ACTIVITY: AMINO ESTERS OF SUBSTITUTED BENZILIC, GLYCOLIC AND ACETIC ACIDS AND RELATED COMPOUNDS

(L. C. Card No. Mic 59-2688)

Kumbla Vittal Nayak, Ph.D.
The University of Tennessee, 1959

Major Professors: Drs. Calvin A. Buehler and Hilton A. Smith

Several derivatives of substituted benzilic, glycolic and acetic acids were prepared in order to investigate their physiological activity. The new compounds which were prepared in the course of this research are listed below.

Hydrochlorides of 2-diethylaminoethyl esters of:
1. 2-Methylbenzilic acid. 2. 3-Methylbenzilic acid. 3. 4-Methylbenzilic acid. 4. 2,3-Dimethylbenzilic acid. 5. 2,4-Dimethylbenzilic acid. 6. 2,5-Dimethylbenzilic acid. 7. 2,6-Dimethylbenzilic acid. 8. 3,4-Dimethylbenzilic acid. 9. 3,5-Dimethylbenzilic acid. 10. 2,3,4-Trimethylbenzilic acid. 11. 2,3,5-Trimethylbenzilic acid. 12. 2,3,6-Trimethylbenzilic acid. 13. 2,4,5-Trimethylbenzilic acid. 14. 2,4,6-Trimethylbenzilic acid. 15. 3,4,5-Trimethylbenzilic acid. 16. 2,3,4,5-Tetramethylbenzilic acid. 17. 2,3,4,6-Tetramethylbenzilic acid. 18. 2,3,5,6-Tetramethylbenzilic acid. 19. 2,3,4,5,6-Pentamethylbenzilic acid. 20. 4-Phenylbenzilic acid. 21. 2,2'-Dimethylbenzilic acid. 22. 3,3'-Dimethylbenzilic acid. 23. 4,4'-Dimethylbenzilic acid. 24. 3,5,3',5'-Tetramethylbenzilic acid. 25. 4,4'-Diisopropylbenzilic acid. 26. 2,2'-Dimethoxybenzilic acid. 27. 4,4'-Dimethoxybenzilic acid. 28. 2,3,2',3'-Tetramethoxybenzilic acid. 29. 3,4,3',4'-Tetramethoxybenzilic acid. 30. 3,4-Methylenedioxybenzilic acid. 31. 2-Methylphenylcyclohexylglycolic acid. 32. 3-Methylphenylcyclohexylglycolic acid. 33. 4-Methylphenylcyclohexylglycolic acid. 34. 2,3-Dimethylphenylcyclohexylglycolic acid. 35. 3,5-Dimethylphenylcyclohexylglycolic acid. 36. 2,4,6-Trimethylphenylcyclohexylglycolic acid. 37. 3,4,5-Trimethylphenylcyclohexylglycolic acid. 38. 2,3,5,6-Tetramethylphenylcyclohexylglycolic acid. 39. 3,3'-Dimethylphenylcyclohexylglycolic acid. 40. 2-Methyldicyclohexylglycolic acid. 41. 3-Methyldicyclohexylglycolic acid. 42. 4-Methyldicyclohexylglycolic acid. 43. 2,3-Dimethyldicyclohexylglycolic acid. 44. 2,4-Dimethyldicyclohexylglycolic acid. 45. 2,6-Dimethyldicyclohexylglycolic acid. 46. 3,4-Dimeth-

yldicyclohexylglycolic acid. 47. 3,5-Dimethyldicyclohexylglycolic acid. 48. 2,3,5-Trimethyldicyclohexylglycolic acid. 49. 2,3,6-Trimethyldicyclohexylglycolic acid. 50. 3,4,5-Trimethyldicyclohexylglycolic acid. 51. 4-Cyclohexyldicyclohexylglycolic acid. 52. 2,2' Dimethyldicyclohexylglycolic acid. 53. 3,3'-Dimethyldicyclohexylglycolic acid. 54. 4,4'-Dimethyldicyclohexylglycolic acid. 55. 1,1-Diphenyl-1-thioacetoxyacetic acid. 56. 1,1-Diphenyl-1-(isopropthio) acetic acid. 57. Phenyl-Δ^2-cyclohexenylacetic acid. 58. Phenyl-Δ^2-cyclohexenylglycolic acid.

Four other compounds prepared were: 59. 2-Diethylaminoethyl 1,1-diphenyl-1-(2-diethylaminoethoxy)-acetate dihydrochloride. 60. 2-Diethylaminoethyl 1,1-diphenyl-1-bromoacetate hydrobromide. 61. 1,1-Diphenyl-2-hydroxy-4-N,N-dimethylbutylamine hydrochloride. 62. Oxalate of 2-N,N-diethylaminoethyl methylamide of benzoylformic acid.

The above compounds have been or will be tested for their physiological activity. Following is the list of new compounds which were obtained as intermediates or as by-products in the preparation of the above compounds.

63. Diphenylcarboxymethyl N-phenylthiolcarbamate. 64. 1-Mercaptodiphenylacetic acid. 65. 1-Mercapto-3,3'-dimethyldiphenylacetic acid. 66. 1-Mercapto-2,2'-dimethoxydiphenylacetic acid. 67. 4-Methylphenylcyclohexylglycolic acid. 68. 3,5-Dimethylbenzoyl cyanide. 69. 3,5-Dimethylphenylcyclohexylglycolic acid. 70. Phenyl-2,3-dibromocyclohexylacetic acid. 71. 1,1-Diphenyl-1-(1-mercaptoacetoxy)-acetic acid. 72. Benzoylformyl chloride. 73. 1,1-Diphenyl-2-acetoxy-4-N,N-dimethylamino-1-butene hydrobromide.

The melting points of 23, 60, 63, and 64, which have been reported before, differ from those found in the present work. Microfilm $2.30; Xerox $8.00. 175 pages.

CONJUGATIVE TRANSMISSION IN CYCLOPROPANE SYSTEMS

(L. C. Card No. Mic 59-2590)

George G. Odian, Ph.D.
Columbia University, 1959

The synthesis, ultraviolet spectra and proofs of configuration of several meta and para substituted trans-2-phenylcyclopropanecarboxylic acids are described. Conclusive evidence was obtained in support of the stereochemical assignment to the isomers of 2-phenylcyclopropanecarboxylic acid melting at 106° and 93° of cis and trans, respectively.

The pK's of the series of meta and para substituted trans-2-phenylcyclopropanecarboxylic acids in dilute aqueous solution at 25° were determined potentiometrically and the Hammett ρ for the reaction calculated. Comparison to the ρ for the dissociation of trans-cinnamic acid and β-phenylpropionic acid indicates that the cyclopropane ring does not transmit conjugation in the ground state.

Opposite to what is found in the cinnamic acid system, trans-2-phenylcyclopropanecarboxylic acid was found to be a stronger acid than the corresponding cis isomer.

Microfilm $2.00; Xerox $4.60. 88 pages.

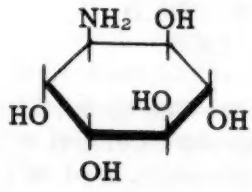
THE APPLICATION OF CATALYTIC AIR OXIDATION IN THE CYCLITOL SERIES

(L. C. Card No. Mic 59-2776)

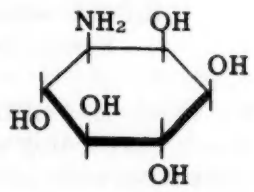
Gerald George Post, Ph.D.
The University of Wisconsin, 1959

Supervisor: Associate Professor Laurens Anderson

The platinum-catalyzed air oxidation of L-inositol has been studied and the product has been identified as D-myo-inosose-1. Reduction of the phenylhydrazone of this inosose provided two new optically active inosamines, MA and MB. Evidence is presented to show that MA is L-inosamine 2 (I) and MB is D-myo-inosamine-1 (II).



I



II

The absolute configurational formulas of all six possible monomethyl ethers of myo-inositol have been established by the use of catalytic air oxidation. Oxidation of pinitol, a methyl ether of D-inositol, and reduction of the resulting inosose with sodium amalgam provided an unequivocal synthesis of sequoyitol and thereby established that this ether is 5-O-methyl-myo-inositol. Quebrachitol, a methyl ether of L-inositol, on similar treatment gave (-)-bornesitol. (Sodium borohydride was used as the reducing agent.) The intermediate inosose was shown by the periodate oxidation of its phenylhydrazone and of the corresponding deoxyinositol to be D-3-O-methyl-myo-inosose-1. It follows that (+)- and (-)-bornesitol are D- and L-1-O-methyl-myo-inositol respectively. The oxidation of monoisopropylidene-quebrachitol and subsequent reduction with sodium borohydride gave (+)-ononitol and thereby established it as L-4-O-methyl-myo-inositol. With this knowledge, unequivocal formulas can be written for the two remaining ethers; (-)-ononitol is the D-4-isomer, and the synthetic compound of m.p. 212° C (Angyal et al., J. Chem. Soc. 1957, 1417) is 2-O-methyl-myo-inositol.

In addition to the cases cited above, the catalytic air oxidations of sequoyitol and bornesitol have been studied. To determine the sites of oxidation, the structure of the inosose formed in each case was established by one or more of the following methods: identification of the reduction products, periodate oxidation of the phenylhydrazone, or hydrogenolysis to the corresponding deoxy compound which was then identified by periodate oxidation and by demethylation.

These studies have established the specificity of catalytic air oxidation in the cyclitol methyl ether series. This specificity can be expressed by the following generalizations:

1. Only axial hydroxyls are oxidized.
2. Where there are two adjacent axial hydroxyls, only one is oxidized.
3. Where two axial hydroxyls are disposed in such a way that two diastereoisomeric inososes could be formed, the oxidation of one hydroxyl takes place preferentially.

The hydrogenolysis of inososes in acid solution has been

studied and a new feature of this reaction has been observed. It was shown that cyclohexanetetrols are formed in this reaction when an axial hydroxyl group is adjacent to the carbonyl group.

Microfilm $2.00; Xerox $3.00. 52 pages.

A STUDY OF THE STEREOCHEMISTRY OF DISPLACEMENT REACTIONS IN 1,3-DIOLS AND DIBROMIDES AND OF ADDITIONS TO DIMETHYLCYCLOPROPANES AND 3,1,O-BICYCLOHEXANE

(L. C. Card No. Mic 59-1205)

Hillard Warren Pouncy Jr., Ph.D.
Syracuse University, 1958

Prior to the date of this study, there has been no report of any work concerning neighboring group interaction of compounds where the active groups are separated by three carbon atoms. It was the purpose of this investigation to compare a series of reactions with the reactive centers separated by three carbons with the better known series with centers separated by two carbons. Specifically: the conversion of certain 1,3-diols to dibromo compounds was to be compared with the conversion of 2,3-butanediol and 3-bromo-2-butanol to 2,3-dibromobutane, reactions which are known to take place with retention of configuration: the conversion of the dibromo compounds to cyclopropane derivatives was to be compared with the conversion of 2,3-dibromobutane to 2-butene, known to take place by trans elimination; and finally, cleavage of the cyclopropane ring with bromine was to be compared with the addition of bromine to 2-butene, known to take place by specific trans addition. In passing, it would be necessary to establish the stereochemical structure of necessary intermediates.

2,4-pentanediol (b_{14} 101-102°), produced by reduction of 2,4-pentanedione with hydrogen and nickel, was separated into its pure meso isomer (m.p. 45°) and an impure dl form (liquid) which was resolvable with D-camphorsulfonyl chlorides and pyridine. Each of the forms (meso, dextro and levo) as well as the original reduction mixture was separately reacted with phosphorous tribromide and with dry hydrogen bromide. The meso form and phosphorous tribromide produced nearly pure (98+ %) dl-2,4-dibromopentane; all other reactions gave varying percentages of dl and meso dibromides. The reactions were best explained in terms of the formation of a bromohydrin followed by the formation of a "bromonium" ion cyclic intermediate.

Meso-2,4-dibromopentane (b_{17} 70-72°; d^{20} 1.6507; N_D^{20} 1.5001) and dl-2,4-dibromopentane (b_{17} 72-74°; d^{20} 1.6261; N_D^{20} 1.4932) were separated by careful fractionation and the dl form was partially resolved with brucine.

Each of the dibromides (dl, meso and levo) was reacted with zinc in 80% ethanol and produced a separable mixture of cis-1,2-dimethylcyclopropane (b_{750} 36.5°; N_D^{20} 1.3825) and trans-1,2-dimethylcyclopropane (b_{750} 28.5; N_D^{20} 1.3738) in a three to two ratio. The trans-1,2-dimethylcyclopropane obtained from the levo dibromide was dextrorotary. The formation of a carbanion at the number two carbon atom followed by the concerted elimination of bromine from the number four carbon atom and ring formation was suggested as a possible mechanism for ring closure.

The reaction of either cis or trans-1,2-dimethylcyclopropane with bromine and ferric chloride gave 2,4-dibromopentane as the primary product. The analogous reactions with bromine and ultraviolet light gave 1,3-dibromo-2-methylbutane (b_{17} 78-80°; d^{20} 1.7023; N_D^{20} 1.5100) as the principle product. The formation of a carbonium ion intermediate appears to be a logical step in the reaction of the 1,2-dimethylcyclopropanes with bromine and ferric chloride. It was suggested that with bromine and ultraviolet light the reaction involved substitution of a bromine atom on one of the methyl groups followed by ring splitting with hydrogen bromide.

Cis-hexahydroresorcinol (1,3-dihydroxycyclohexane) or a mixture of cis and trans isomers is converted by dry hydrogen bromide to a separable mixture of cis-1,3-dibromocyclohexane (m.p. 111-112°) and trans-1,3-dibromocyclohexane (m.p. 1°). When phosphorous tribromide is used in place of dry hydrogen bromide the cis-hexahydroresorcinol produced only trans-1,3-dibromocyclohexane while the mixture of cis and trans glycol gave a mixture of cis and trans dibromides. It appeared that the "bromonium" ion cyclic intermediate formed only when it was preceeded by a trans bromohydrin.

Each of the dibromocyclohexanes (cis and trans) were converted to 3,1,O-bicyclohexane (b.p. 78°; N_D^{20} 1.4329) by zinc and n propyl alcohol.

Bromine alone or bromine and ferric chloride converts 3,1,O-bicyclohexane to trans-1,3-dibromocyclohexane and to a bromine containing solid (m.p. 43-44°) of undetermined structure.

The reaction of phosphorous tribromide with each meso-2,4-pentanediol and cis-hexahydroresorcinol to produce nearly pure dl-2,4-dibromopentane from the former and nearly pure trans-1,3-dibromocyclohexane from the latter was best explained in terms of a neighboring group interaction by the first bromine to become attached to the starting compounds.

The fact that both dl- and meso-2,4-dibromopentane gave the same proportions of cis- and trans-1,2-dimethylcyclopropane and the production of 3,1,O-bicyclohexane from either cis- or trans-1,3-dibromocyclohexane indicated the lack of sterospecificity of ring closure under the conditions of this experiment.

Microfilm $2.00; Xerox $4.20. 80 pages.

THE MECHANISMS OF THE REACTIONS OF CHLOROETHYLENES WITH p-TOLUENESELENOLATE REAGENT

(L. C. Card No. Mic 59-1637)

Glenn Ronald Price, Ph.D.
Purdue University, 1959

Major Professor: William E. Truce

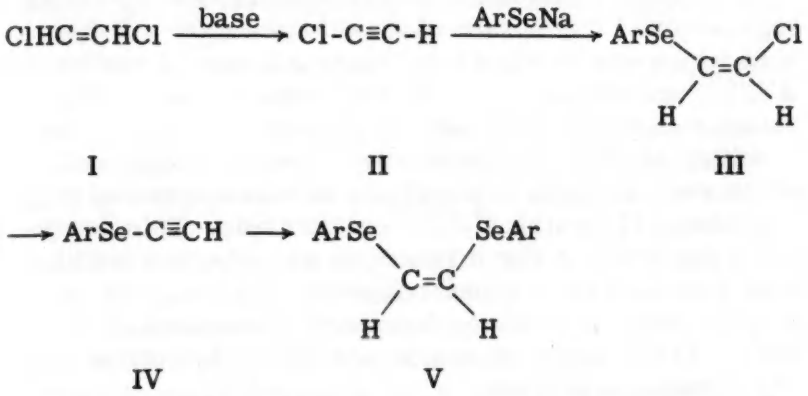
This investigation was concerned with the reactions of the nucleophilic agent, p-tolueneselenol, and several chlorinated ethylenes. Previous work has indicated that the reactions of nucleophilic agents with haloolefins may proceed by at least two different mechanisms, i.e., either initial beta-elimination to form an acetylenic intermediate followed by nucleophilic addition, or initial nucleophilic

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addition to form a saturated intermediate or an incipient carbanion followed by the loss of HX or X^-, respectively.

The first part of these studies concerned the reaction of vinyl chloride with p-tolueneselenolate reagent in which a simple elimination-addition mechanism was followed.

The second part of these studies concerned the reactions of p-tolueneselenolate reagent with cis- and trans-dichloroethylene, which both proceeded according to the mechanism outlined below to form the final product, cis-bis-(p-tolylseleno)ethene.

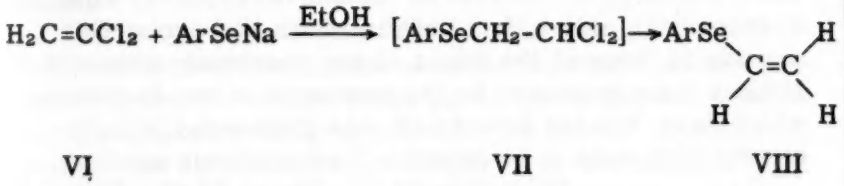


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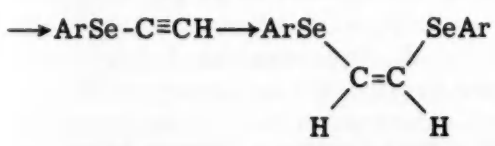
IV V

Both the dichloroethylenes proceeded by the same mechanism, however, forcing conditions had to be employed in the case of the trans isomer due to its difficult dehydrohalogenation.

The third part of these studies concerned the reactions of vinylidene chloride and vinyl chloride with p-tolueneselenolate reagent. The vinylidene chloride-p-tolueneselenolate system proceeded to form cis-bis-(p-tolylseleno)ethene as the final product by the addition elimination mechanism outlined below:

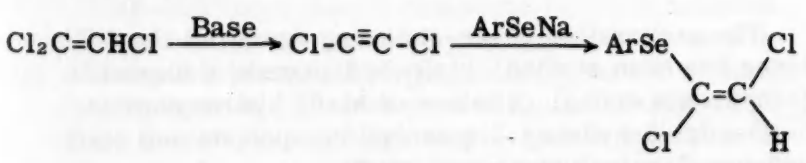


VI VII VIII

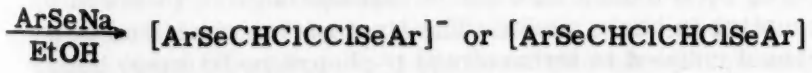


IV V

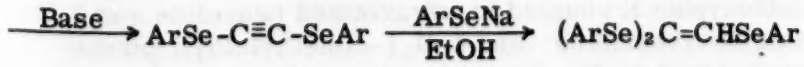
The fourth part of these studies concerned the mechanism of the reactions of trichloroethylene with p-toluene-selenolate reagent, forming tris-(p-tolylseleno)ethene as the final product.



IX X XI



XIIa XIIb



XIII XIV

The final part of this study concerned itself with the measurement of the dipole moments of a number of the intermediates obtained in these reactions. This dipole moment data was used to corroborate the structures of the intermediates which had been previously assigned on the basis of chemical and spectral data.

Microfilm $2.15; Xerox $7.60. 163 pages.

STERIC AND ELECTRONIC EFFECTS IN OLEFIN FORMATIONS

(L. C. Card No. Mic 59-2674)

Garson Phillip Shulman, Ph.D.
Syracuse University, 1959

The object of this investigation was to elucidate the principles governing olefin-forming elimination reactions. Three independent approaches were followed.

The first involved eliminations giving mixtures of sym-dialkylethylenes or of trialkylethylenes. In the 3-heptyl series bimolecular processes (chloride plus base, quaternary ammonium hydroxide, or alcohol plus sulfuric or phosphoric acid) give 55-66% of 2-heptene, but unimolecular processes (pyrolyses of hydrogen phthalate, xanthate, or amine oxide, and probably aluminum oxide dehydration) give 43-48% of 2-heptene. These results are most easily explained by electronic effects in the first group, and by steric effects in the second group.

Dehydration of 2,4-dimethyl-3-hexanol with sulfuric or phosphoric acid gives 58-60% of the 2-hexene, which is in accord with expectations based on hyperconjugation and on the 3-heptyl series; but the bromide with base gives 51% of the 2-hexene. Pyrolyses of the acetate and of the hydrogen phthalate give strikingly high (100 and 75%) proportions of the 2-hexene, but aluminum oxide gives only 49% of the 2-hexene.

The second approach used alicyclic systems of known stereochemistry. Both cis and trans-2-methylcyclohexanol give predominately 1-methylcyclohexene (79 and 71%), indicating that trans elimination is easier. Action of base on the chloride is more clear-cut, giving 79 and 44% of 1-methylcyclohexene. Dehydration over aluminum oxide is a little easier with the trans alcohol, indicating a tendency towards cis elimination. Pyrolysis of the hydrogen phthalates gives chiefly phthalic anhydride and the alcohol. The cis xanthate gives equal amounts of 1- and 3-methylcyclohexene, unexpected on the basis of the usual cis mechanism, but explainable on the basis of preferred conformation. The trans xanthate gives 56% of 1-methylcyclohexene in the presence of hydroquinone but 67% in the presence of benzoyl peroxide, indicating a likely free radical path.

And the third approach considered a case in which the steric probabilities of the two products differed. The pyrolysis of 2,5-dimethyl-3-hexyl acetate gives 94% of sym-diisopropylethylene, going in the proper direction despite potential steric hindrance.

Microfilm $2.00; Xerox $6.40. 135 pages.

A KINETIC STUDY OF THE EFFECT OF SOLVENTS ON THE AMINOLYSIS OF ETHYLENE CARBONATE

(L. C. Card No. Mic 59-2275)

Charles Anthony Signorino, Ph.D.
University of Pennsylvania, 1959

Supervisors: Dr. Allan R. Day and Dr. John G. Miller

An investigation of the reaction between isopropylamine and ethylene carbonate was made with respect to the effect of the solvent on the reaction kinetics. The reaction was run in benzene with varying amounts of ethyl alcohol present. Reaction mixtures with different initial concentrations of the amine and carbonate were run in a series of solvents which were 1, 2, 5, and 8 molar ethyl alcohol in benzene. The reactions were also run in pure benzene and absolute ethyl alcohol.

The reaction mixtures were made up in a 100 ml. volumetric flask. Nine aliquots were taken from each mixture. Two aliquots were analyzed immediately and the remaining ones were retained in a constant temperature bath to be analyzed periodically as the reaction progressed. The concentration of the alcohol and benzene were always the same since they were not used up in the reaction. The concentration of the amine could be found by titration. The aliquot to be analyzed was emptied into a measured excess of HCl solution. The excess acid was back titrated by NaOH. Knowing the amount of HCL added and the amount of NaOH necessary to neutralize the mixture, the difference gave the amount of amine present. Since the amine and carbonate reacted in a 1 to 1 stochiometric ratio the concentration of the carbonate at the time of analysis can be calculated when the initial concentration is known.

The data indicated that this reaction, when run in a solvent containing 1 mole ethyl alcohol in benzene, was a second order kinetic process no matter what the initial concentrations of isopropylamine and ethylene carbonate were. However, when a second mole of alcohol is present in the solvent, the reaction becomes third order no matter what the initial concentrations of the reactants were. A reaction run in the 2 molar alcohol solvent designed to isolate the kinetic order of the amine was second order. A similar reaction designed to isolate the kinetic order of the carbonate was first order. This indicated that the increase in kinetic order of the reaction was involving a second molecule of amine.

As the alcohol concentration in the solvent increased the rate of the reaction increased and the complexity continued to increase. The runs in absolute alcohol were most rapid and most complex. The runs in pure benzene were auto-catalytic and their kinetic order was never established. Another study on a series of runs containing dioxane in place of benzene behaved similarly except that their rate was much slower. In a series of runs where the solvent was isopropyl alcohol in benzene, a behavior similar to that in the ethyl alcohol-benzene solvent was observed.

The rate and complexity of the reaction of isopropylamine and ethylene carbonate are increased as the concentration of ethyl alcohol in the solvent is increased.

Microfilm $2.00;Xerox $4.20. 79 pages.

THE SYNTHESIS OF 18,19-BISNORPROGESTERONE AND APPROACHES TO THE SYNTHESIS OF 18-NORSTEROIDS

(L. C. Card No. Mic 59-2599)

Alan Jere Solo, Ph.D.
Columbia University, 1959

Estradiol-3-methyl ether 17-tosylate was converted to 3-methoxy-17-methyl-18-nor-$\Delta^{1,3,5(10),13(17)}$-estratetraene by acetolysis. This olefin was ozonized to the corresponding diketone. Cyclization of the diketone gave a D-homoenone which was reduced to a trans-antitrans-3-methoxy-$\Delta^{1,3,5(10)}$-estratriene-17-one, stereospecifically. The ketone was treated with methyl magnesium iodide. The resulting alcohol was dehydrated to the Δ^{16} compound, which was ozonized, cyclized and then hydrogenated to give 3-methoxy-17-acetyl-$\Delta^{1,3,5(10)}$-estratriene. This compound was subjected to a Birch reduction and was then oxidized with chromic acid-acetone reagent to 17ϵ-18,19-bisnorprogesterone. The stereochemistry established at the A/B and C/D ring-junctions was demonstrated by optical rotatory dispersion studies.

Various approaches to the synthesis of 3-hydroxy-18-nor-$\Delta^{13(17\alpha)}$-androstene-17-one, a key intermediate in a proposed synthesis of 18-norsteroids, were explored. Acetolysis of dihydrotestosterone-17-tosylate gave only a 20% yield of the pseudo-androstene-3-one and a large amount of liquid olefin. Subsequent transformations demonstrated that the liquid contained more of the desired olefin, but no satisfactory fractionation procedure could be devised. Attempts to solvolyse the tosylate in dimethylformamide or in t-butanol-t-butoxide solution failed. The Bamford-Stevens reaction on isoandrosterone-17-tosylhydrazone gave only a liquid olefin which had properties similar to those of the liquid olefin previously obtained. None of the approaches to the synthesis of the D-homoenone, which have thus far been tried, has proceeded in sufficiently high yield to be practical for synthetic applications.

Microfilm $2.00; Xerox $4.40. 83 pages.

SYNTHESIS OF BIS CHELATING AGENTS FOR THE PRODUCTION OF COORDINATION POLYMERS

(L. C. Card No. Mic 59-2919)

Forrest Dean Thomas II, Ph.D.
The Pennsylvania State University, 1959

The preparation of bis-chelating agents of the following types has been studied: bis(o-hydroxyazo) compounds, bis-(o-hydroxyketones), diimines of bis(o-hydroxyketones), bis(5-acyl-8-hydroxy-7-quinolyl) compounds and bis(8-hydroxy-5-quinolylazo) compounds.

Two series of bis(o-hydroxyazo) compounds were prepared by standard methods of tetrazotization, followed by coupling in basic media. The first series consisted of p-cresol coupled to tetrazotized p-phenylenediamine, benzidine, 4,4'-diaminodiphenylmethane, 4,4'-diaminobibenzyl, 3,3'-dimethylbenzidine, and 3,3'-dimethoxybenzidine: 4-methoxyphenol coupled to tetrazotized benzidine and 3,3'-dimethoxybenzidine: and 4-(1,1-dimethylethyl)-phenol coupled to 3,3'-dimethoxybenzidine. The second series

consisted of 3-methyl-1-phenyl-5-pyrazalone coupled to tetrazotized p-phenylenediamine, benzidine, 4,4'-diaminodiphenylmethane, 4,4'-diaminobibenzyl and 3,3'-dimethoxybenzidine.

Di-p-tolyl esters of the aliphatic dicarboxylic acids malonic through and including sebacic, diglycolic and thiodiglycolic were prepared by the action of phosphorus oxychloride on p-cresol and the appropriate acid. Di-p-tolyl esters of the aromatic dicarboxylic acids phthalic, isophthalic, and terephthalic were prepared from p-cresol and the appropriate acid chloride. Acetic anhydride and 4,4'-biphenol gave 4,4'-biphenol diacetate.

All of the diesters were subjected to the double Fries rearrangement (aluminum chloride and ester) with, and in some cases, without solvent. The expected bis(o-hydroxyketones) were obtained with few exceptions these being; (1) di-p-tolyl oxalate which gave 2-hydroxy-5-methylbenzoic acid; (2) di-p-tolyl malonate which gave 4-hydroxy-6-methylcoumarin; (3) di-p-tolyl diglycolate, which gave no rearranged products; and (4) di-p-tolyl phthalate which gave 1-hydroxy-4-methylanthraquinone. The Fries rearrangement of di-p-tolyl terephthalate also caused acylation of the solvent, chlorobenzene, to give a small amount of 1,4-bis(4-chlorobenzoyl)benzene.

The infrared spectra of the bis(o-hydroxyketones) show no absorption characteristic of the free phenolic hydroxyl group, but showed strong bands which were attributed to the hydroxyl group hydrogen-bonded to the o-carbonyl group and to the carbon-hydrogen stretching frequency. There were also strong absorptions characteristic of a shifted carbonyl and of the benzene ring.

Bis(o-hydroxy imines) were prepared from n-butyl amine and the 1,6-bis, 1,8-bis, and 1,10-bis(o-hydroxyketones).

The 8-hydroxyquinoline esters of acetic, propanoic, butanoic, benzoic and adipic acid were prepared and subjected to the Fries rearrangement; but in no case was the desired 5-acyl-8-hydroxyquinoline derivative obtained.

In order to study the feasibility of preparing bis(8-hydroxyquinolyl) compounds by the Friedel-Craft reaction (aluminum chloride, acid chloride and 8-hydroxyquinoline) 5-acetyl-, 5-chloroacetyl-, 5-propanoyl-, and 5-benzoyl-8-hydroxyquinoline derivatives were prepared. Attempted preparation of 5-chloroacetyl-8-hydroxyquinoline resulted in the acylation of the solvent, chlorobenzene, to give 4,-dichloroacetophenone. Attempted preparation of 1,6-bis-(8-hydroxy-5-quinolyl)hexane-1,6-dione by the Friedel-Craft reaction also resulted in the acylation of only the solvent, chlorobenzene, to give a small amount of 1,6-bis(4-chlorophenyl)hexane-1,6-dione. None of the desired 5,5'-bis(8-hydroxyquinolyl) compound could be isolated. The 5-formyl derivative of 8-hydroxyquinoline was prepared from 8-hydroxyquinoline, chloroform and ethanolic sodium hydroxide. The reaction of formaldehyde with 5-formyl-, 5-acetyl- and 5-benzoyl-8-hydroxyquinoline resulted in the formation of the corresponding bis(5-acyl-8-hydroxy-7-quinolyl)methane derivatives.

Bis(8-hydroxy-7-quinolyldiazo) compounds were prepared by coupling 8-hydroxyquinoline in basic media to tetrazotized benzidine, 4,4'-diaminodiphenylmethane and 4,4'-diaminobibenzyl.

Microfilm $2.00; Xerox $6.40. 131 pages.

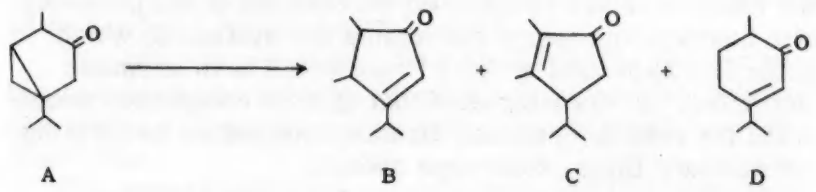
THE ACID-CATALYZED AND THERMAL ISOMERIZATIONS OF THUJONE

(L. C. Card No. Mic 59-2830)

Alfred Vernon Winn, Ph.D.
Stanford University, 1959

The acid-catalyzed and thermal isomerizations of thujone have been restudied.

It was found that thujone (A) when added to concentrated sulfuric acid was converted very rapidly to three products. These products were shown by infrared and ultraviolet spectral analysis and degradation where necessary to be 3,4-dimethyl-2-isopropyl-5-oxocyclopentene (B) (20%), 1,2-dimethyl-3-isopropyl-5-oxocyclopentene (C) (40%), and carvenone (D) (40%).



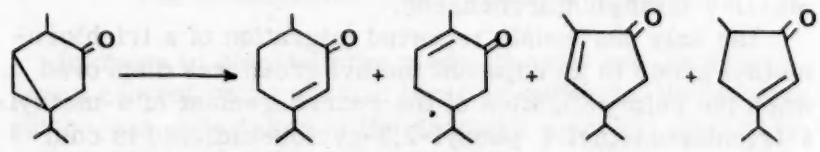
A B C D

Of the products found only 1,2-dimethyl-3-isopropyl-5-oxocyclopentene (C) has been reported previously. Carvotanacetone (E) which has been reported as a product was not detected.

It was proposed that thujone when treated with concentrated sulfuric acid goes to products by way of the tertiary cyclopentyl and cyclohexyl carbonium ions which are predicted by applying Markownikoff's rule to the addition of protons to the cyclopropane group in thujone. The cyclopentyl carbonium ion loses protons from either side of the charged center to yield 3,4-dimethyl-2-isopropyl-5-oxocyclopentene (B) and 2,3-dimethyl-1-isopropyl-4-oxocyclopentene which isomerizes further to 1,2-dimethyl-3-isopropyl-5-oxocyclopentene(C). The cyclohexyl carbonium ion yields only carvenone (D). It was shown that an equilibrium does not exist among the products.

When thujone was treated with 48% hydrobromic acid, dilute sulfuric acid, or when an acetic acid solution of thujone was treated with hydrogen chloride the products obtained were p-cymene, 1,2-dimethyl-3-isopropyl-5-oxocyclopentene (C) and carvenone (D). 3,4-Dimethyl-2-isopropyl-5-oxocyclopentene (B) was not detected except in the case of the reaction with hydrobromic acid where a bromo-derivative was suspected as an intermediate.

In the thermal reaction, thujone when refluxed or heated at 280° in sealed tubes was converted mainly to carvotanacetone (E). Some carvenone (D) and two compounds which were shown to be conjugated oxocyclopentenes having the formula $C_9H_{14}O$ were separated from the remaining products.



A D E F G

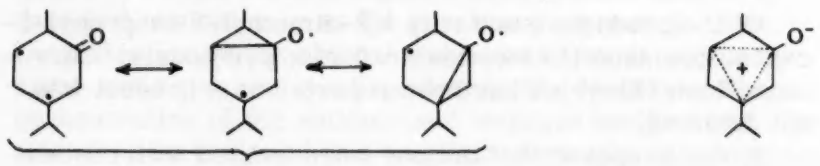
Because the C_9 compounds were assumed to have been formed by the loss of methylene radicals from the cyclopropane group in thujone and because of their infrared absorption spectra, the structures 1-methyl-3-isopropyl-5-oxocyclopentene (F) and 4-methyl-2-isopropyl-5-oxocyclopentene (G) were assigned.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

It was found that d-isothujone undergoes thermal isomerizations more rapidly than does l-thujone at lower temperatures. A noticeable reaction rate was observed in the case of d-isothujone even at 100°. The rates of isomerization at 280° were practically the same, apparently, because at that temperature l-thujone and d-isothujone were soon equilibrated through the common enol form to a mixture of the two.

It was found that aged thujone contained substances which catalyze its thermal isomerization. The addition of p-benzoquinone and related substances also caused marked increases in the rates of product formation.

It was proposed that thujone when heated is converted to products by way of a diradical intermediate (H) which is stabilized by homoallylic resonance. It was proposed further that the diradical is particularly stable, accounting for the reaction at low temperatures, because of the presence of a homocyclopropenyl carbonium ion system (I) which according to Hückel's "4n+2" rule would have aromatic character. It was suggested that quinoid compounds accelerate the rate determining diradical formation by forming a transitory Diels-Alder type adduct.



H I

Microfilm $2.00; Xerox $6.80. 143 pages.

THE CHEMISTRY OF 4-METHYL-4-TRICHLOROMETHYL-2,5-CYCLOHEXADIENONES

(L. C. Card No. Mic 59-2754)

Louis Leonard Wood, Ph.D.
The Ohio State University, 1959

The reaction of p-cresol with carbon tetrachloride in the presence of aluminum chloride to give 4-methyl-4-trichloromethyl-2,5-cyclohexadienone (I) and the rearrangement of I with phosphorus pentachloride to 3-methyl-4-trichloromethylchlorobenzene have been reported. In the work presented here an attempt was made to synthesize 3,5-dimethyl-4-trichloromethylchlorobenzene by a similar sequence of reactions. 3,4-Dimethyl-4-trichloromethyl-2,5-cyclohexadienone (II) was prepared for the first time from 3,4-dimethylphenol, carbon tetrachloride, and aluminum chloride. When treated with phosphorus pentachloride II underwent a new arrangement to yield 3-(β,β,β-trichloroethyl)-4-methylchlorobenzene.

The only previously reported migration of a trichloromethyl group to an adjacent methyl group was disproved when the reinvestigation of the rearrangement of 4-methyl-4-trichloromethyl-1-phenyl-2,5-cyclohexadienol in cold concentrated formic acid showed that 4-methylbiphenyl was actually formed and not 4-ethylbiphenyl.

Further investigations revealed two more new rearrangements: (a) the reaction of II with polyphosphoric acid to give 2-chloro-4,5-dimethylbenzoic acid, 3,4-dimethylchlorobenzene, and phosgene; and the reaction of I with polyphosphoric acid to give 4-chloro-2-methylbenzoic acid, 4-chlorotoluene and phosgene. Mechanisms for the reaction of I and II with phosphorus pentachloride and polyphosphoric acid were proposed.

Attempts to prepare trichloromethylcyclohexadienones by the reaction of o-cresol, 2,6-dimethylphenol, 2,4,6-trimethylphenol and 4-phenylphenol with carbon tetrachloride and aluminum chloride were unsuccessful. 4-Ethyl-4-trichloromethyl-2,5-cyclohexadienone, however, was prepared for the first time by the reaction of 4-ethylphenol, carbon tetrachloride, and aluminum chloride.

Microfilm $2.00; Xerox $5.80. 120 pages.

CHEMISTRY, PHYSICAL

I. AN INVESTIGATION OF ELECTRICAL CONDUCTIVITY IN LIQUID AMMONIA UNDERGOING RADIOLYSIS. II. TRITIUM LABELING CAUSED BY IONIZING RADIATION IN TRITIUM-HYDROCARBON MIXTURES. III. HYDROGEN EXCHANGE BETWEEN URANIUM HYDRIDE AND HYDROCARBONS.

(L. C. Card No. Mic 59-2761)

Rolland William Ahrens, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor John E. Willard

Conductivity measurements were made on liquid ammonia undergoing radiolysis with Co^{60} γ-rays in order to determine whether or not solvated electrons were formed as a result of the absorption of ionizing radiation in the liquid. Permanent decreases in the cell resistance of the liquid during irradiation were probably due to ionic species which were knocked out of the Pyrex glass cell walls or out of the platinum electrodes. The increase in cell resistance observed when the 250-curie cobalt-60 γ-source was removed from close proximity to the conductivity cell was partly due to a decrease in temperature of the cell. When the concentration of conducting impurities in the liquid ammonia was sufficiently small (about 2×10^{-6} eq. $1.^{-1}$), the increase in cell resistance upon removal of the cobalt-60 source was more than twice as large as the change which could be ascribed to a decrease in temperature of the cell. The variation of cell resistance with time after Co^{60} source removal was first corrected for temperature variation of the cell and was then assumed to represent a steady-state concentration of ions produced radiolytically in the liquid ammonia. The concentration of these ions was calculated assuming an equivalent conductance of 1040 $ohm^{-1}cm.^2$ The average of 3 determinations was 3.5×10^{12} ion pairs $ml.^{-1}$ The value for the equivalent conductance (1040 ohm^{-1} $cm.^2$) used in these calculations involved the assumption that the negative ions produced during the radiolysis were ammoniated electrons. From the dose rate (1.13×10^{18} ev $ml.^{-1}min.^{-1}$) and the calculated steady-state ion pair concentration it was possible to calculate a value of 3.9×10^{-11} ml. ion $pair^{-1}sec.^{-1}$ for the bimolecular rate constant for the recombination of the radiolytically-produced ions.

Exploratory studies were made of some of the reactions occurring in mixtures of alkanes and tritium irradiated by

Co^{60} γ-rays and by tritium beta-particles. After irradiation tritiated products in each sample were separated on a gas chromatography column and were detected in a flow-type proportional counter. Under the conditions of the experiments it was found that in an irradiated mixture of methane and tritium about 0.1% to 0.7% of the tritium was incorporated into saturated hydrocarbon product molecules having from 1 to 8 carbon atoms in the carbon chain. Chain-lengthened tritiated products did not seem to be inhibited by iodine under the conditions of these experiments.

Exploratory studies were made of the hydrogen exchange reactions between hydrocarbon molecules and uranium hydride in the presence of uranium metal. Mass spectrometric analyses showed that multiply deuterated ethanes were formed simultaneously at 35°C. in an exchange reaction between $C_2H_6^1$ and UH_3^2 in a U-UH_3^2 mixture. At a temperature of 100°C. $C_6H_6^2$ was formed in an exchange reaction between $C_6H_6^1$ and UH_3^2 in a U-UH_3^2 mixture. The exchange reactions were similar to those observed by other investigators in studies of exchange reactions catalyzed by metal films.

Microfilm $2.55; Xerox $8.80. 195 pages.

MOLECULAR FORCE FIELDS OF ETHYLENE, ALLENE, FORMALDEHYDE, KETENE, AND DIAZOMETHANE

(L. C. Card No. Mic 59-2683)

Charles Edward Bailey, Ph.D.
The University of Tennessee, 1959

Major Professor: William H. Fletcher

The orbital valency force field, which is essentially a Urey-Bradley force field modified to interpret bending vibrations in terms of the changes in bonding orbital overlap which occur during the bending motions, has been applied to ethylene, allene, formaldehyde, ketene, and diazomethane. Each of these molecules possesses double bonds, and it was hoped that the bending force constants could be correlated with the changes in orbital overlap based on a model in which the molecular orbitals were assumed to be formed by overlapping directed atomic orbitals.

The vibrational potential energy expressions were simplified by assuming that the H----H repulsions in the molecules were negligible, and the results obtained show that this assumption was justified. Therefore, only the van der Waals repulsions between the H atoms and the nearest nonbonded C, N or O atoms were necessary. The fact that all of the off-diagonal elements in the $\mathcal{F}$ matrix of a molecule were either zero or functions of the same constant permitted a range of solutions for the force constants to be obtained independently for both the light molecule and the heavy molecule. The best solution for the force constants was obtained by plotting values of the diagonal $\mathcal{F}$ matrix elements versus the constant in the off-diagonal elements and determining the value of the constant in the off-diagonal elements for which the best agreement in the values of the diagonal elements for the light and heavy molecules was obtained.

It was shown that when the values of all but n independent force constants in a species of order n are fixed, the n! sets of solutions which exist for the n independent force constants arise because of the n! ways in which the n frequencies belonging to the species can be permuted. This correlation can be used to choose the correct set of force constants (if all but n of the constants have been fixed) when data are available for only one isotopic species.

The repulsive force between the non-bonded carbon and hydrogen atoms in ethylene, allene, and ketene, and the non-bonded oxygen and hydrogen atoms in formaldehyde were in agreement with the calculated repulsion based on a Lennard-Jones potential in which the hydrogen atoms were considered as helium atoms and the carbon and oxygen atoms were considered as neon atoms. However, in diazomethane, it was found that an electrostatic attractive force exists between the hydrogen atoms and one of the nitrogen atoms (probably the terminal nitrogen atom) which is stronger than the repulsive force between the hydrogen atoms and the central nitrogen atom.

The agreement between the calculated frequencies and the observed frequencies for all the molecules is excellent, the average error in general being considerably less than 1 per cent.

The orbital valency force constants obtained for ethylene, allene, formaldehyde, and ketene were correlated in terms of the structures of the molecules. The force constants associated with the torsional vibrations of ethylene and allene were found to be quite similar, indicating that the concept of orbital overlap is quite good for this type of motion. The agreement between the constants associated with the changes in orbital overlap of the σ and π bond orbitals which occur during planar and non-planar bending modes was not as good as in the case of the torsions. However, the agreement is as good as that found when corresponding bending force constants of different molecules obtained using a valency force field are compared. It is felt that the orbital valency force field provides a means of increasing our understanding of the nature of the forces acting during bending vibrations, and that further calculations utilizing data for similar molecules, in addition to refinements in the theory, will lead to a clear picture of bending vibrations.

Microfilm $2.70; Xerox $9.20. 205 pages.

A VOLTAMMETRIC STUDY OF THE CORRELATIONS BETWEEN LIMITING CURRENTS, VISCOSITY AND DIFFUSION COEFFICIENTS

(L. C. Card No. Mic 59-2873)

William Eugene Bauer, Ph.D.
The Pennsylvania State University, 1959

In order to elucidate the mass transfer mechanisms which control voltammetric limiting currents, an investigation was undertaken at the dropping mercury electrode in quiescent solutions and at the stationary microconical platinum indicator electrode in flowing solutions. The variation of two types of polarographic diffusion coefficients was investigated in quiet solutions as a function of viscosity, viz. "Fick diffusion coefficients," defined in terms of a concentration gradient and "activity diffusion coefficients," defined in terms of an activity gradient. Data were obtained

for the reduction of oxygen in aqueous sucrose solutions at 37.0°C. and in aqueous glycerol solutions at 80.0°C. in a range of viscosities between 0.4 and 9 centipoise. Results were compared critically with corresponding diffusion coefficients obtained at 25.0°C. for viscosities between 1 and 125 centipoise.[1] In all instances, Fick diffusion coefficients failed to satisfy a Stokes-Einstein type relationship. Quite generally, the variation of activity diffusion coefficients as a function of viscosity was characterized by two distinct patterns of behavior corresponding to the following two solvent structure domains: (1) A "non Stokes-Einstein domain," where the solvent possessed an "ice-like" structure; (2) A "Stokes-Einstein domain," where the solvent medium had a closely packed structure. It was postulated that glycerol caused the breakdown of the ice-like structure by primary ("inner shell") hydration and a "wedge effect" due to the inability of glycerol molecules to fit into the lattice positions of the tetrahedral structure of liquid water. In contradistinction, the effect of sucrose was attributed principally to long range effects such as "outer shell hydration," where the force fields about the polar sucrose molecules caused distortion of the ice-like water structure even though there was no actual formation of "hydrate bonds."

The voltammetry of oxygen was studied at flow velocities between 180 and 610 cm./sec. and viscosities between 0.9×10^{-2} and 2.6×10^{-2} cm.^{2}/sec. The following limiting current equation describes adequately the experimental results:

$$i_l = n\,F\,A\,f\,c\,k\,v^{0.46}\,\nu^{-1}$$

where i_l (expressed in microampere) denotes the limiting current, nF is the number of coulombs per mole involved in the electrode reaction, A (in cm.^{2}) is the effective area of the indicator electrode, f is the molarity activity coefficient of the electroactive species, k denotes a "dimensional constant," v (in cm./sec.) is the flow velocity and ν (in cm.^{2}/sec.) denotes the kinematic viscosity of the solution. The equation indicates that the microconical platinum electrode exhibited the characteristics of a "convection electrode."[2] The corresponding currents were controlled by the rate of oxygen mass transfer through a quasi-rigid boundary layer adsorbed on the electrode surface.

Microfilm $2.00; Xerox $4.20. 80 pages.

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ACTIVITY COEFFICIENT BEHAVIOR AS A FUNCTION OF STRUCTURE AND MEDIA

(L. C. Card No. Mic 59-2874)

Henry Edward Berkheimer, Ph.D.
The Pennsylvania State University, 1959

The H_R function (formerly called C_o and J_o) is evaluated spectrophotometrically for 0 to 58% nitric acid-water and 0 to 60% perchloric acid-water. The equilibrium constants of all the indicators studied are shown to be independent of the solvent; this is added proof that the activity coefficient ratio term $\frac{f_{R^+}}{f_{ROH}}$, is independent of the structure of the indicator.

The application of acidity functions and activity coefficients to kinetics and equilibria is discussed, and the H_R function is shown to correlate the shifts in the nitrous acid-nitrosonium ion equilibrium in perchloric acid.

The McGowan equation, an equation relating distribution coefficients to molecular volume, is shown to be valid for substances of widely varying solubilities, sizes, and shapes. This equation can be used to predict activity coefficient ratios and is thus an extremely valuable tool for the prediction of many chemical phenomena.

A modification of this equation to include substances which bond to solvent is examined and found to be useful. The test of a proposed equation for ions, in which the McGowan equation is combined with the Born equation, yielded inconclusive results.

Microfilm $2.00; Xerox $6.20. 130 pages.

THE MECHANISM OF LIQUID PHASE NITRATION OF ALIPHATIC HYDROCARBONS

(L. C. Card No. Mic 59-2707)

Devin King Brain, Ph.D.
The Ohio State University, 1954

The mechanism of liquid-phase nitration of saturated hydrocarbons is as yet not clearly understood. The literature on this reaction is inconclusive because of the lack of continuity in the various approaches to the problem and because of the inaccurate evaluation of the structures and compositions of the nitration products.

However, a few fundamental generalizations have been established on the basis of experimental evidence which are of importance in consideration of reaction mechanism. These are (1) that the relative rates of nitration of hydrogen atoms of hydrocarbons are tertiary > secondary > primary[1,2]; (2) that neohexane undergoes nitration to give 2, 2-dimethyl-3-nitrobutane (no evidence was found for carbon skeleton rearrangement[3]); and (3) that nitration of bridge-head positions does not occur.[4]

Several attempts have been made to assign a mechanism to liquid phase nitration of hydrocarbons. From the nitration of (-)-3-methyloctane, Stevens and Schiessler[5] obtained a tertiary nitroalkane, 3-methyl-3-nitrooctane, which exhibited a small rotation (α_D^{25}-0.65°). No study was made of the stereochemical aspects of the displacement. However, the optical activity of the tertiary nitro compound was assumed to eliminate any mechanism involving free alkyl radicals. In consideration of this data and the fact that camphane cannot be nitrated on the bridge-head position, Stevens and Schiessler postulated that substitution occurs by a one-step acceptor-donor mechanism of the homolytic type in which the hydrogen is replaced as an atom and stereospecificity of the asymmetric center is maintained.

In consideration of the reactivity of the hydrogen atoms and the electrophilic nature of nitric acid, Ingold[6] has proposed that the nitration of an alkane is an electrophilic substitution on carbon (S_E2).

Titov,[7] on the basis of the ease of nitration of the alkyl

chains of triphenylmethane, diphenylmethane, and toluene with nitric acid or nitrogen dioxide, suggests that nitration is a radical reaction initiated by attack of the nitrating agent, nitrogen dioxide, on the hydrogen atom of the alkyl group. The alkyl radical may then react with various other radicals produced by the decomposition of nitric acid and thus give the observed nitration products. This mechanism is substantiated by the following facts: (1) Nitration of aliphatic hydrocarbon does not occur in the absence of nitrogen dioxide; (2) nitration takes place in solvents of low dielectric constant; (3) the rate of nitration is directly proportional to the concentration of nitrogen dioxide; and (4) strong acids have no particular effect on the reaction velocity.

The Present Research

The research conducted in the present study to clarify the mechanism of liquid phase nitration of aliphatic hydrocarbons consisted of three parts: (1) nitration of (±)-3-methylheptane and of (+)-3-methylheptane; (2) nitration of commercial and cis- and trans-decalins; and (3) nitration of cis- and trans-hydrindanes.

(+)-3-Methylheptane ($[\alpha]_D^{26}$ +9.25) was nitrated with 50 per cent nitric acid at 100° for 12 hours. The unreacted hydrocarbon that was recovered was virtually unracemized under the conditions of nitration ($[\alpha]_D^{26}$ +9.15°). The resulting mixture of nitro products was treated 4 times with equivalent amounts of sodium methoxide in methanol in order to remove the primary and secondary nitro compounds and other acidic products of nitration. The rectified 3-methyl-3-nitroheptane exhibited essentially no rotation (α_D^{25} -0.04°). There was little change in the observed rotation at other wavelengths. In order that any errors derived in determination of the optical rotation might be obviated, and also as an independent method of synthesis and structural confirmation, (±)-3-methyl-3-nitroheptane was prepared from (±)-3-methylheptane. Since the racemic 3-methyl-3-nitroheptane prepared from (±)-3-methylheptane had optical properties which were identical with that of the 3-methyl-3-nitroheptane obtained from (+)-3-methylheptane, the latter product was considered to be a racemate.

As further proof of the inactivity of the 3-methyl-3-nitroheptane prepared from (+)-3-methylheptane, the nitro compound was reduced to 3-amino-3-methylheptane with hydrogen and Raney nickel. The amino compound in 30 per cent ethanol did not rotate polarized light over a series of wavelengths. As final proof, the 3-amino-3-methylheptane from 3-methyl-3-nitroheptane obtained from (+)-3-methylheptane was converted to N-phenyl-N'-3(3-methylheptyl)-thiourea in 60 per cent yield. The crude derivative (m.p. 74-76°) and the purified product (m.p. 79°) exhibited no rotation over a series of wavelengths. The physical properties (infrared spectra, boiling points, refractive indices, densities, and rotations) of the 3-methyl-3-nitroheptane, 3-amino-3-methylheptane, and N-phenyl-N'-3(3-methylheptyl)thiourea prepared from (+)-3-methylheptane were essentially identical to those of the corresponding compounds prepared from (±)-3-methylheptane. The analysis for N-phenyl-N'-3(3-methylheptyl)thiourea from 3-amino-3-methylheptane obtained from (+)-3-methylheptane was excellent. It is therefore concluded that the steric identity of the asymmetric center of (+)-3-methylheptane is lost in its conversion to 3-methyl-3-nitroheptane by the action of 50 per cent nitric acid.

Commercial decalin, cis-decalin, and trans-decalin were each nitrated with 50 per cent nitric acid at 100° for 5 hours. The infrared spectra and the refractive indices for unreacted cis- and trans-decalins indicate that the hydrocarbon is not isomerized under the nitration conditions. The tertiary nitro product from each decalin was separated from its secondary isomers and rectified to give pure "9-nitrodecalin." The physical properties of the 3 "9-nitrodecalins" were identical with each other. By reduction of the "9-nitrodecalin" with hydrogen and Raney nickel, "9-aminodecalin" was obtained; the properties of the "9-aminodecalins" were identical upon preparation of the acetamides of these amines. It was found that regardless of the origin of the 9-amino-decalin (commercial, cis- or trans-decalin) a single homogeneous N-9-decalylacetamide was obtained (m.p. 183°). The melting points of the mixed derivatives was not depressed.

In view of the fact that the infrared spectra of the 9-nitrodecalin obtained from commercial, cis-, and trans-decalin contains strong peaks characteristic of trans-decalin ring systems, it may be concluded that the "9-nitrodecalin" is trans-9-nitrodecalin. This structural assignment is in agreement with that arbitrarily chosen by Hückel[8] and with that which might be predicted on the basis of ring strain and steric effects.

9,10-Dinitrodecalin was also isolated from nitration of commercial, cis-, and trans-decalin. The 9,10-dinitrodecalin was identical irrespective of the stereochemistry of the original parent hydrocarbon. Its infrared spectrum exhibits strong absorption characteristic of the transring system.

Cis- and trans-hydrindane were nitrated at 100° with 50 per cent nitric acid. "8-Nitrohydrindane" was isolated upon treatment of the product with base and subsequent rectification. The unreacted hydrindane recovered from each nitration was identical with the initial material. The "8-nitrohydrindanes" exhibited identical physical properties (infrared spectra, refractive indices, densities, and analyses); the physical properties of the corresponding 8-aminohydrindanes prepared by the reduction of the 8-nitrohydrindanes were also practically identical. N-8-Hydrindylacetamide was prepared from the "8-aminohydrindane" by reaction with acetic anhydride and 20 per cent sodium hydroxide. The derivatives gave excellent analyses and melted at 88°; the melting point of the mixed derivatives was not depressed.

The homogeneity and similarity of the 8-aminohydrindane derived from either cis- or trans-hydrindane was demonstrated further upon preparation of their N-8-hydrindylbenzamides; the derivatives melted at 98°, and on the basis of their analyses and mixed melting points, were identical. It is thus concluded that nitration of either cis- or transhydrindane yields identical 8-nitrohydrindane.

From the fact that trans-decalin gave enhanced absorption when nitro groups were substituted for tertiary hydrogen atoms, it might be expected that similar results would be obtained for the hydrindanes. There was a noticeable absence of trans peaks, however, in the spectra of the 8-nitrohydrindane and strong indication of an enhanced cis peak. From these results it may be concluded that 8-nitrohydrindane prepared from either cis- or trans-hydrindane is of the cis structure. The structural assignment is not completely compatible with that expected on the basis of steric hindrance and ring strain.

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Conclusions

The liquid phase nitration of aliphatic hydrocarbons may possibly involve one or a combination of many mechanisms. However, as a result of the evidence provided by the present research, it has been established that a center undergoing nitration loses its stereochemical identity. In order to account for this fact, it may be surmized that the intermediate which becomes symmetrical is either a carbonium ion, a carbanion, or a free radical.

The carbonium ion mechanism may be excluded on the basis of the following evidence: (1) Nitration of neohexane gives the normal product without rearrangement; (2) nitration apparently proceeds in solvents of low dielectric constant; (3) strong acids do not accelerate the reaction; and (4) the rate of nitration is a function of the concentration of nitrogen dioxide.

The mechanism involving carbonic intermediates is discredited by the following experimental evidence: (1) The relative reactivities of the hydrogen atoms are $3^0 > 2^0 > 1^0$, and (2) the arguments (2,3,4) of the above discussion.

The mechanism involving alkyl free radicals proposed by Titov[7] in which reaction is initiated by removal of a hydrogen atom from the hydrocarbon by nitrogen dioxide is compatible with the findings of the present research. This mechanism is further substantiated by the evidence that (1) the nitration proceeds in solvents of low dielectric constant; (2) the effect of strong acids is negligible; (3) the reaction rate is a function of the concentration of nitrogen dioxide; and (4) the order of reactivity of replaceable hydrogens is from tertiary to secondary to primary.

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Microfilm $2.00; Xerox $6.00. 125 pages.

Abstract published by special arrangement with The Ohio State University.

THE INFRARED SPECTRUM AND STRUCTURE OF A SINGLE CRYSTAL OF ETHYLENE

(L. C. Card No. Mic 59-2573)

Charles Irving Brecher, Ph.D.
Columbia University, 1959

Thin oriented sections of single crystals of ethylene were grown in an apparatus designed to allow spectroscopic investigation of the specimens in the infrared region. Spectra of three distinct single crystal specimens, at -180°C, were recorded between 650 and 3600 cm^{-1}, with the incident radiation unpolarized, and also with the electric vector of the radiation polarized parallel, in turn, to each of the two perpendicular extinction directions of the specimens as determined in visible light, which had been found to be the polarization directions for maximum dichroism. Spectra of polycrystalline, liquid, and vapor specimens, with equivalent absorbing paths, were also recorded.

Twenty-nine absorption bands were measured and identified in the crystal, as compared with eighteen in the liquid, and only eight in the vapor. A number of combinations not previously reported have been observed and assigned, and several crystal bands attributable to sums or differences of lattice modes with fundamentals have been identified.

The orientation of the crystal sections relative to the incident radiation was determined, and a crystal structure model for ethylene has been proposed. This structure, beginning to space group P $2_1/n$ (C_{2h}^5), is consistent with the spectroscopic data, and with previous crystal structure information regarding the lattice of the carbons. Other previously suggested structures are found to involve difficulties not present in the new model. Also, the "oriented gas" approximation has been used to derive, from the spectroscopic data, two orientational parameters of the molecule relative to the crystal lattice, the values of which agree, within experimental error, not only among the three different specimens, but also with those calculated from the crystal structure model.

On the basis of this new crystal structure model, a possible explanation for the "pre-melting" phenomenon of ethylene is suggested. The process would involve a disordering of the molecules relative to their orientation around their carbon-carbon axes, and would be similar to the non-first order transitions of various other substances except that the ethylene crystal melts before the transition is completed. For the bearing it may have on other cases of a similar nature, further study of this phenomenon is suggested. Microfilm $2.00; Xerox $5.60. 115 pages.

THE RATE OF ISOTOPIC OXYGEN EXCHANGE BETWEEN WATER AND ALIPHATIC ALCOHOLS AND ITS RELATIONSHIP TO THE MECHANISM OF ALCOHOL-OLEFIN INTERCONVERSION

(L. C. Card No. Mic 59-2876)

Robert Henry Boyd, Ph.D.
The Pennsylvania State University, 1959

Taft has proposed a mechanism for the aliphatic olefin-tertiary alcohol interconversion in aqueous acid media

which involves, as the rate-determining step, the isomerization of a pi-complex and a classical carbonium ion. By this mechanism a prior step in the dehydration of an alcohol is the rupture of the carbon-oxygen bond of the protonated alcohol to produce a carbonium ion-like intermediate. This intermediate may then combine with a solvent molecule or eliminate a proton.

The present study was initiated in an attempt to further elucidate Taft's mechanism. Of particular interest was the reaction involving the rupture of the carbon-oxygen bond in the dehydration sequence and the nature of the intermediate formed.

The hydration of gaseous 1-methyl-1-cyclobutene was investigated at 25°C. in 2.52 M nitric acid solution. The dehydration rates of tert-butyl and tert-amyl alcohols were investigated as functions of the acidity of the medium. The effects of acidity and carbinol structure on the rate of oxygen-18 exchange between tert-carbinols and water were investigated. Several tert-alkyl chlorides were solvolyzed in water at 50°C., and the ratios of alcohol to olefin formed during the solvolyses were measured.

The results may be summarized as follows.

(1) The application of Brown's I-strain rules to the relative hydration rates, dehydration rates, and equilibria of small-ring compounds led to the conclusion that there is no appreciable covalent bonding of a water molecule to the central carbon atom in the transition state for the alcohol-olefin interconversion. A comparison of the relative rates of hydration of 1-methyl-1-cyclobutene and 1-methyl-1-cyclopentene led to the conclusion that the transition state of the alcohol-olefin interconversion possesses the electronic aspects of a classical carbonium ion but not the structural aspects. Both of the above conclusions are consistent with the mechanism proposed by Taft for the aliphatic alcohol-olefin interconversion.

(2) The rates of dehydration of tert-butyl and ter-amyl alcohols at unit concentration were found to parallel Hammett's acidity function h_0 (antilog of H_0).

(3) The fact that both the hydration rate and the dehydration rate of the olefin-alcohol interconversion parallel h_0 places serious doubt on the general validity of the Zucker-Hammett hypothesis.

(4) The rate constants for the oxygen-18 exchange of tert-alcohols with water were found to obey the equation, log $k_{ex} = -\rho H_0 +$ constant, with ρ varying from 1.20 to 1.47.

(5) The rate constants for oxygen-18 exchange of carbinols of the formula $XCH_2C(CH_3)_2OH$ were found to follow Taft's σ^* ρ^* relationship.

(6) The similarity of structural effects on the tertiary alkyl halide solvolysis rates and the oxygen-18 exchange rates implies a close similarity of mechanisms. Since the well-studied halide solvolysis reaction proceeds by a carbonium ion-type mechanism, this is the preferred mechanism for oxygen-18 exchange.

(7) The effect of leaving group on the rate-controlled product ratios resulting from the solvolysis of tert-alkyl compounds in water was found to be considerably more pronounced in water than in 80 percent aqueous ethanol, where essentially no effect is observed. It has been noted that in water each leaving group (Cl^-, H_2O, and N_2) produces a characteristic effect on the product ratio (substitution to elimination). These results are explained on the basis of a stretched-bond intermediate.

(8) It was concluded that the elimination reaction and the oxygen-18 exchange reaction proceed by common steps but involve different rate-determining steps.

Microfilm $2.00; Xerox $6.60. 137 pages.

SYNTHETIC STUDIES ON 2-PYRROLIDINONES AND INTRODUCTION OF THE PROPIONIC ACID GROUP INTO CERTAIN 2-PYRROLIDINONES

(L. C. Card No. Mic 59-2710)

Wendell Mason Byrd, Jr., Ph.D.
The Ohio State University, 1954

For the elucidation of the structure of chlorophyll it is necessary to determine the location of two hydrogen atoms which are at present assumed to be substituents at positions 7 and 8 in ring IV. These positions carry also a methyl and a propionic acid group, respectively. An important preliminary step to the ultimate synthesis of chlorophyll is the synthesis of the 3,4-dihydro pyrrole structure with reactive centers in positions 2 and 5 and the above mentioned substituents. Such a compound should be combined with a suitably substituted pyrrole to form a α,α'-pyrrylpyrrolinylmethane analogous to the combination of rings I and IV or rings III and IV in chlorophyll.

The dissertation deals with the syntheses of several substituted 2-pyrrolidinones of the type shown in Fig. 1, where R_1 is phenyl or methyl and R_2 is ethyl or methyl.

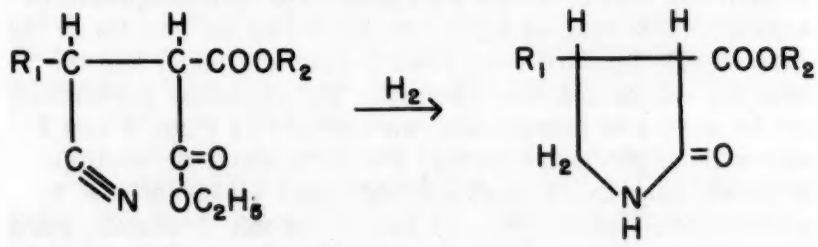


Figure 1.

These were prepared by the low pressure hydrogenation (4 atms.) and ring closure of the corresponding ethyl 3-cyano-2-ethoxycarbonylpropionates by means of a modification of the procedure of Koelsch and Stratton,[1] who employed high pressure hydrogenation (100 atms.). Alkaline Raney Nickel W-7[2] effected ester interchange in all experiments where the alcohol used as solvent was different from the alcohol radical in the cyano esters.

Compounds containing the propionic acid group as shown in Fig. 2, where R_1 is phenyl or methyl and R_2 is ethyl or methyl, were synthesized in two ways. One was by the

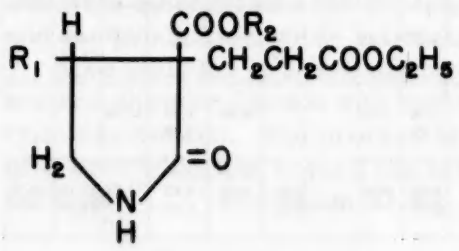


Figure 2.

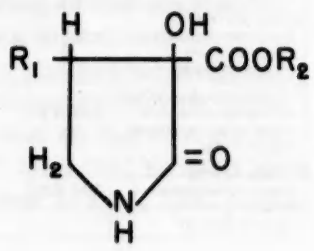


Figure 3.

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alkylation of the 3-alkoxycarbonyl-2-pyrrolidinones with ethyl β-chloropropionate in the presence of sodium ethoxide. The other was by the alkylation of 3-substituted ethyl 3-cyano-2-ethoxycarbonylpropionates with subsequent hydrogenation and ring closure. The fact that the same compounds were obtained by both methods shows that alkylation occurs on the carbon at position 3 and not on the oxygen at position 2.

The reactivity of the 2-carbonyl position in several 2-pyrrolidinones was studied, and it was hoped that through this group a condensation could be effected. The failure of the carbonyl group to condense with the usual reagents, such as semicarbazide or 2,4-dinitrophenylhydrazine, was not surprising in view of the fact that the structure is a cyclic amide.

The N-methyl-2-pyrrolidinones have been shown to be reactive towards Grignard reagent,[3] and this was considered a promising approach to the contemplated condensation reaction. However, the product obtained was not caused by carbonyl reaction, but by secondary reaction to yield 3-carboxy-4-phenyl-2-pyrrolidinone from the ethyl ester of the latter.

The action of phosphorus pentachloride on 3-ethoxycarbonyl-4-phenyl-2-pyrrolidinone to prepare the corresponding 2-chloropyrrolines, and the addition of hydrogen cyanide to the same compound to synthesize the nitrile, were tried since the products of both reactions should have been very useful for further studies. However, these experiments were unsuccessful and produced tars in the case of phosphorus pentachloride, and no reaction occurred when hydrogen cyanide was used.

The reactivity of the alpha positions in the 2-pyrrolidinones was hoped to be increased by oxidation to the corresponding succinimides with potassium permanganate in acetone. This type of alpha oxidation was successful in the case of 3,3-dimethyl-5-methyl-2-pyrrolidinone, and the 5-hydroxy compound was obtained. The oxidation performed on the series of compounds represented by Figs. 1 and 2, where R_1 is phenyl or methyl and R_2 is ethyl or methyl, attacked only the 3 position, and good yields of the 3-hydroxy derivatives (Fig. 3), but no ketonic products, were isolated. Reaction at this position is to be expected owing

Compound	N-H	C-H	O-H	C≡N	ester C=O	C=O / C=N	COOH	C_6H_5	$-CH_2-$	ester C-O-C	C_2H_5	C_6H_5	cyclic ring
Ethyl 3-cyano-2-ethoxy-carbonyl-3-phenyl-propionate		3.35		4.47	5.72 5.79			6.24 6.70	6.91	8.35 8.52	11.66	13.25 14.35	
Ethyl 3-cyano-2-ethoxy-carbonylbutyrate		3.34		4.45	5.71 5.73				6.89	8.34 8.49	11.62		
3-Methoxycarbonyl-4-phenyl-2-pyrrolidinone	3.12	3.32			5.77	5.90		6.23 6.70	6.97	8.34		13.23 14.39	12.62
3-Carboxy-4-phenyl-2-pyrrolidinone	3.08	3.34	3.60 3.83			5.96	5.73	6.20 6.72	6.93			13.29	14.56
3-Methoxycarbonyl-4-methyl-2-pyrrolidinone	3.13	3.38			5.78	5.88			6.98	8.31 8.42			12.78 14.67
4-Phenyl-2-pyrrolidinone	3.11	3.32				5.97		6.21 6.69	6.92			13.26 14.40	12.86
3-Hydroxy-3-methoxy-carbonyl-4-methyl-2-pyrrolidinone Figure 6 Top	3.09	3.35	3.00		5.69	5.82			6.97	8.53			14.52
3-Ethoxycarbonyl-3-hydroxy-4-phenyl-2-pyrrolidinone Figure 6 Bottom	3.05	3.35	2.98		5.70	5.88		6.21 6.71	6.88		11.67	13.35 14.38	12.63
3-(2-Ethoxycarbonylethyl)-3-methoxycarbonyl-4-methyl-2-pyrrolidinone Figure 5 Top	3.03	3.35			5.72 5.76	5.82			6.92	8.33 8.48	11.68		
3-Ethoxycarbonyl-3-(2-ethoxycarbonylethyl)-4-phenyl-2-pyrrolidinone Figure 5 Bottom	3.07	3.35			5.73 5.78	5.90		6.22 6.69	6.96	8.33 8.48	11.67	13.18 14.27	12.70

Fig. 4.-Assignments of Groups to Characteristic Frequencies in the Infrared Absorption Spectra

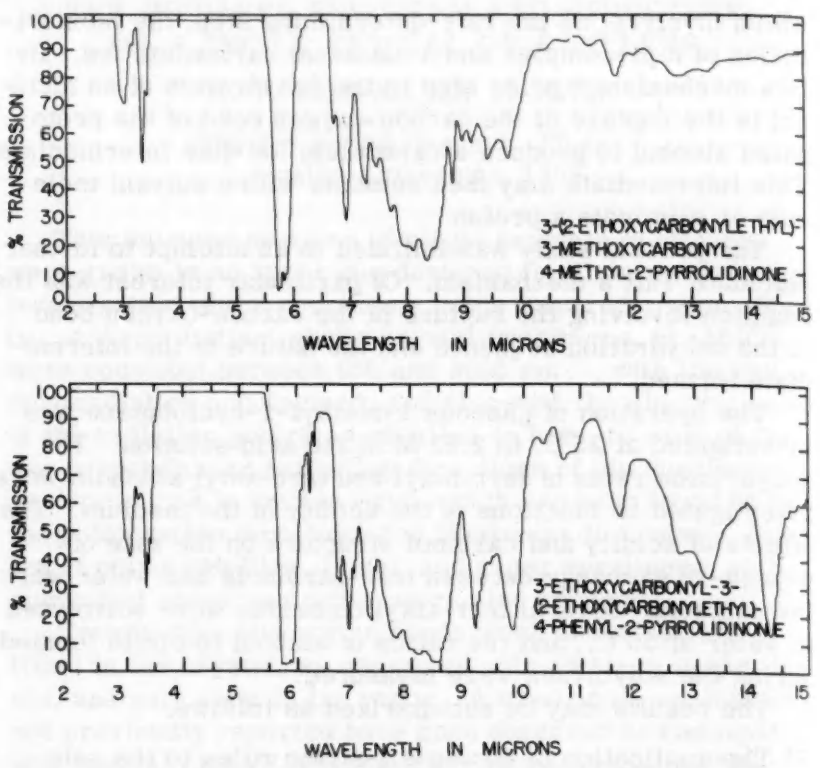


Fig. 5.

to the activation of the hydrogen atom by both the 3-ethoxycarbonyl group and the amide linkage in the ring. On the other hand, the hydroxy compounds as well as the 2-pyrrolidinones carrying only hydrogen in the 3 position resist further oxidation. The introduction of the 2-ethoxycarbonylethyl group causes the same behavior.

The infrared absorption spectra of the starting materials and the 2-pyrrolidinones prepared from them were recorded. The functional groups and their assigned absorption frequencies are shown in Fig. 4. The actual absorption curves of the compounds containing the propionic acid substituent (Fig. 2) and the hydroxy compounds (Fig. 3) obtained from the oxidation reaction are shown in Figs. 5 and 6, respectively.

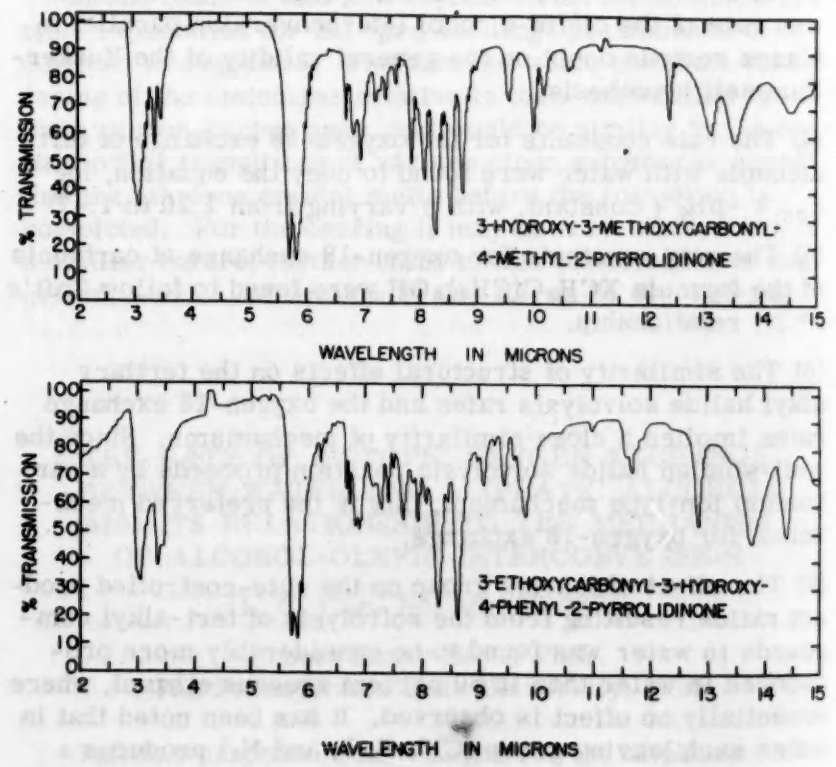


Fig. 6.

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SUMMARY

1. The synthesis of 3-ethoxycarbonyl-4-phenyl-2-pyrrolidinone was modified by hydrogenating at low pressure instead of high pressure.
2. The syntheses of the methyl and ethyl esters of 3-carboxy-4-methyl-2-pyrrolidinone are described.
3. The introduction of the propionic acid ester side chain was accomplished by alkylation of the esters of 3-carboxy-2-pyrrolidinones.
4. Alkylation at position 3 was verified by the introduction of the side chain before hydrogenation and ring closure.
5. The oxidation of 2-pyrrolidinones with potassium permanganate was studied and yielded four new 3-hydroxy compounds.
6. With $-CH_2-$ or $-CR_1R_2-$ in the 3 position, no oxidation in this position was observed.
7. A high melting form of 3-carboxy-4-phenyl-2-pyrrolidinone was obtained from the saponification of the methyl and ethyl esters; a possible explanation based on stereochemical considerations is presented and discussed.
8. The partial resolution of 3-carboxy-4-phenyl-2-pyrrolidinone was accomplished.
9. The ethyl ester of 3-carboxy-4-phenyl-2-pyrrolidinone did not react with Grignard reagent except by causing the hydrolysis of the ester in secondary reaction.
10. The reaction with phosphorus pentachloride to produce a 2-chloropyrroline was unsuccessful.
11. The infrared absorption spectra are given for the cyano compounds, and the new 2-pyrrolidinones were prepared from them.
12. A series of 2-pyrrolidinones was synthesized, and by alkylation, compounds containing substituents as found in the dihydrogenated ring of chlorophyll were prepared. Consideration was given to the possibility of altering the carbonyl group to allow condensation to an α,α'-pyrrylpyrrolinylmethane and ultimately to a chlorin.

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Microfilm $2.00; Xerox $4.40. 84 pages.

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A STUDY OF THE KINETICS OF THE GASEOUS REACTION OF TRIMETHYLBORANE AND OXYGEN

(L. C. Card No. Mic 59-2735)

James Edward Coleman, Ph.D.
The Ohio State University, 1959

The reaction of gaseous trimethylborane and oxygen at pressures (10 to 20 mm.) below the explosion limit has been studied at 19.9 and -20.1°C. in glass vessels – a spherical vessel 8.0 cm. in diameter and a vessel made of concentric cylinders.

At 19.9°C. the reaction yields dimethylborylmethylperoxide in essentially quantitative amounts. The order of the reaction varies somewhat with the relative pressures of reactants between 0.5 and 1.0 for trimethylborane and 1.5 and 2.0 for oxygen. Addition of inert gases causes a reduction of the initial rate and addition of the product(s) causes an increase. An increase of the surface to volume ratio by a factor of three (accompanied by a change in geometry in changing from the spherical to the cylindrical reactor) causes only a slight increase in the rate. Neglecting the catalytic effect of the products, the rate of the reaction is closely reproduced by an expression of the form

$$\text{Rate} = -\frac{dp}{dt} = \frac{k\, P_{BMe_3}\, P_{O_2}^2}{a + bP_{BMe_3} + cP_{O_2}^2}.$$

It is suggested that the process involves chains which begin and end on the wall, and a mechanism is proposed. Possible chain carriers are discussed.

At -20.1°C. the pressure decrease is somewhat greater than that corresponding to a 1:1 reaction forming the peroxide, and a slight increase in oxygen consumption is noticed. Substitution of initial rates in the above expression requires a negative value for c, and the catalytic effect of the products is reduced.

The overall activation energy is very small.

The explosion limit of trimethylborane and oxygen mixtures has been investigated in the temperature range -30 to 25°C. in spherical vessels. The relationship between the partial pressures of the reactants at the explosion limit is of the form

$$\frac{1}{P_{BMe_3}} = a - b\,\frac{1}{P_{O_2}}.$$

Addition of nitrogen or a decrease in bulb diameter raises the limit. Minimum pressure for explosion occurs at 0.6 mole-fraction of oxygen and is 21.5 mm. at 20.1°C. and 25.2 mm. at -20.4°C. Products of the explosion include hydrogen, methane, carbon monoxide, carbon dioxide, ethane, ethylene, acetylene, methoxydimethylborane, trimethylboroxin and a mixture of unidentified solid products. Possible mechanisms for the triggering of the explosion and the production of the products are discussed.

Also included is a new method for the preparation of methoxydimethylborane and hydroxydimethylborane from trimethylborane. The process is based on the reactivity of trimethylborane toward the acetic acid that is used as a catalyst.

Microfilm $3.90; Xerox $13.20. 304 pages.

CONDUCTANCES OF HYDROGEN HALIDES IN ANHYDROUS ACETONITRILE

(L. C. Card No. Mic 59-2926)

Steven Simeon Danyluk, Ph.D.
Rensselaer Polytechnic Institute, 1959

Supervisor: George J. Janz

The electrical conductivities of the hydrogen halides, HCl, HBr and HI have been investigated in acetonitrile over a wide concentration range under varying conditions. Specific conductances of freshly prepared HCl and HBr solutions were not constant but increased with time to a maximum or "stabilized" value. The conductivity of HI decreased with time initially and then increased to a "stabilized" value.

Molar conductances of "stabilized" solutions of HCl, HBr and HI have been studied as a function of the concentration and the Λ - $\sqrt{M}$ curves indicate that all of the acids behave as weak electrolytes. Acetonitrile acts as a differentiating solvent for the halogen acids, e.g., the molar conductances for a 10^{-3} molar solution are 0.80, 15.2, and 48.3 for HCl, HBr and HI respectively.

The molar conductances for HCl and HBr can be expressed by empirical equations of the form,

$$\Lambda_M = A + \frac{B}{\sqrt{M}}$$

Although an equation of this type has not been reported previously in the literature it applies generally to nonaqueous solutions of ionogens in which considerable solute-solvent interaction occurs, e.g., acetone-HCl, pyridine-HCl and pyridine-HBr.

Solid substrates have been isolated from acetonitrile-hydrogen halide solutions and analyses correspond to compounds of the type $CH_3CN{\cdot}2HX$. The melting points, solubilities and molar conductances were determined for each compound. The infrared spectrum of $CH_3CN{\cdot}2HBr$ is in accord with an imino hydrobromide structure for this compound, while the infrared spectra of $CH_3CN{\cdot}2HCl$-acetonitrile solutions indicate the presence of a nitrilium salt.

An interpretation of the molar conductances on the basis of existing weak electrolyte theories is discussed and inadequacies of ion-solvent and ion-ion interaction concepts in explaining the present conductance data are pointed out. The anomalous conductance behavior of the hydrogen halides in acetonitrile obviates the evaluation of limiting conductances and ionization constants.

In the light of the above the conductance increase with time is attributed in large part to the slow reaction to form imino-type compounds.

Microfilm $2.55; Xerox $8.80. 195 pages.

CATION EXCHANGE IN NON-AQUEOUS SYSTEMS AND IN MIXTURES CONTAINING WATER

(L. C. Card No. Mic 59-2382)

Robert Glenn Fessler, Ph.D.
Duke University, 1959

Supervisor: Howard A. Strobel

Investigations of ion exchange systems have been carried out for a number of years, but only in the past few has much attention been focused on these systems in solvents other than water or in mixed solvents. Of the studies which have been undertaken in non-aqueous-water mixtures, the majority have stopped short of the pure non-aqueous solvent. By turning to anhydrous and a variety of mixed solvent systems, not only will information on the exchange reaction in these systems be provided, but a further insight into the exchange process in general may be afforded.

In this research, equilibrium exchange reactions were studied for different ionic forms of a standard cation exchanger, Dowex 50, in various anhydrous and mixed solvent systems. Swelling measurements were also carried out by a column method for a number of cation exchange resins in water, methanol, and ethanol.

Lithium-hydrogen, sodium-hydrogen, potassium-hydrogen, cesium-hydrogen, ammonium-hydrogen, methylammonium-hydrogen, and sodium-lithium equilibrium quotients were determined in methanol-water mixtures at 0.5 ion fraction. All measurements were made at 30°C with the exception of a few at 18°C for the sodium-hydrogen exchange. A maximum in the equilibrium quotient was found in all but the lithium-sodium system in the vicinity of a dielectric constant of 40, corresponding to about 0.2 mole fraction water in the external solution phase. When the logarithm of the equilibrium quotient was plotted as a function of the reciprocal of the dielectric constant, a linear variation was observed down to the maximum. No maximum was observed in the sodium-lithium exchange systems; rather, the linearity held. Equilibrium quotients for the lithium-hydrogen exchange as a function of the ion fraction in the resin phase were determined in anhydrous methanol.

Additional studies of the equilibrium quotient for sodium-hydrogen exchange in anhydrous ethanol as a function of the composition of the resin phase and in ethanol-water mixtures as a function of solvent composition were undertaken. A maximum in K_H^{Na} was found near a dielectric constant of 40, and the logarithm of K_H^{Na} varied linearly down to the maximum. The plot of log K_H^{Na} versus 1/D was linear over the entire range of solvent composition for the sodium-hydrogen exchange in anhydrous methanol-ethanol mixtures. Acetic acid-water mixtures were chosen as another solvent system for the sodium-hydrogen exchange. A maximum was again observed in the vicinity of a dielectric constant of 40. Down to the maximum, the log K_H^{Na} versus 1/D remained linear. Some miscellaneous exchange studies were carried out in dimethylformamide and in acetone-methanol and acetone-ethanol mixtures.

The swelling behavior of the various resin forms has been interpreted in terms of pressure and solvent effects in the mixed solvent systems.

The behavior of the exchange systems in non-aqueous and mixed solvent systems has been explained in terms of the swelling behavior of the resins and the ion-solvent

interactions. Proton-solvent interaction was shown to be responsible for the appearance of a maximum in some exchange systems. Finally, the linearity observed in log K_c versus 1/D is ascribed to the important role electrostatic interaction plays in determining the equilibrium quotient.

Microfilm $2.20; Xerox $7.60. 165 pages.

REACTIONS AT A PLATINUM CATHODE IN AQUEOUS COPPER(II)BROMIDE SYSTEMS

(L. C. Card No. Mic 59-2624)

Harlan Edward Fiehler, Ph.D.
University of Missouri, 1959

Supervisor: G. Myron Arcand

The use of copper(II)bromide as a dual intermediate in coulometric analysis, developed by Swift and coworkers, was examined in order to explain some anomalous effects observed by G. Myron Arcand. He used this system to titrate the bromine obtained from bromate samples according to the reaction

$$BrO_3^- + 6\,H^+ + 8\,Br^- \text{ --- } 3\,Br_3^- + 3\,H_2O$$

When an equivalent quantity of copper(I) was generated, Arcand noted that there was a delay in reaching the end point. He also established the fact that the bromide and the copper(II) concentration affected the delay.

In checking these facts it was noted that the cathode became covered with an insoluble substance during the generation of copper(I). From the chemical behavior of copper halides and from the evidence of some qualitative tests, it was assumed that the solid was CuBr(s).

The reaction rate between bromine and electrolytically generated copper(I) was studied in solutions that differed in concentrations of bromide and copper(II). When it was found that the rate determining step was the solution of CuBr(s) from the generator cathode, the effect of bromide concentration on this reaction was measured and a rate constant calculated. The rate constant included electrode size, stirring rate, and other factors peculiar to the cell that remained constant. In the rate expression

$$d\,CuBr_2^-/dt = k\,Br^{-n}$$

the value of k is 3.0×10^{-5} equivalents per minute while n, the order of the reaction in this range of bromide concentration (0.15 to 0.45 VF), is 1.7.

Either copper(I) or bromine changed in concentration as the reaction proceeded. The rate of the reaction was followed with an amperometric indicator system by utilizing the copper(I)-copper(II) or the bromide-bromine couple depending on which reactant was in the solution. A constant indicator potential of 185 mv. caused a diffusion current which was calibrated to give the bromine or the copper(I) concentration.

A means of regulating the potential of the indicator system is outlined and the effect of the copper(II)-bromide ratio on the behavior of the copper(I)-copper(II) amperometric indicator current is discussed. The probable cause of the current reversal in the indicator system is also discussed with emphasis on the role that hydrogen might play in this phenomenon.

The formation constant for the complex $CuBr^+$ was determined spectrophotometrically and the molar extinction coefficient calculated for this ion. The formation constant is 0.174 if the ionic strength and acidity are in the vicinity of 1.0. The activity coefficients are included in the formation constant. This value differs from those given in the literature but there is reason to believe that the molar extinction coefficient used by these authors was incorrect. A graphical analysis of the absorption of copper(II)bromide solutions gave a value of 1900 for the molar extinction coefficient of the complex ion, $CuBr^+$, when both the acidity and the ionic strength were regulated.

Other absorption bands were found in the visible and in the near infra-red region. Not enough information is available to positively identify an absorption band with a particular bromide complex of copper(II) but tentative assignments are made on the basis of, the appearance of these bands as the bromide concentration changes, by comparison with the absorption properties of other copper(II) salts, and by general considerations of color absorption by transition metal ions. Absorption bands in copper(II)chloride systems comparable to those in copper(II) bromide solutions are also reported. Microfilm $2.00; Xerox $4.80. 95 pages.

EVIDENCE FROM FORMATION CONSTANT MEASUREMENTS OF DATIVE PI BONDING IN COORDINATION COMPOUNDS

(L. C. Card No. Mic 59-2884)

David Elliott Goldberg, Ph.D.
The Pennsylvania State University, 1959

This investigation is part of a program designed to learn how various factors affect formation constants. Factors previously considered include the use of low ionic strength systems and the use of theoretical relationships to determine true thermodynamic formation constants as opposed to molarity quotients which most other workers obtain. Such data allow the calculation of the thermodynamic quantities enthalpy and entropy as well as free energy. Other factors which have been considered are the effect of the number of donor atoms per ligand, the effect of variation in ring size, and the effect of changing one or more of the donor atoms in similar ligands. Also investigated was the effect of stereochemical properties of cyclic diamines, to see if any difference could be detected between cis and trans diamines in their coordination with metal ions.

Nowhere, however, has there been any systematic investigation on the possible effects of dative pi bonding on formation constants, or on the possibility of establishing the existence of dative pi bonding through formation constant studies. Therefore, an investigation was undertaken to determine if the stabilization due to dative pi bonding in coordination compounds could be shown from the results of formation constant measurements. Formation constants of several amines which would be expected to form d_π-p_π dative bonds and several which could not form dative pi bonds were investigated. The determinations were done over the temperature range 10-40°, and thermodynamic properties of the systems were calculated.

Formation constants were determined for 2-picolylamine,

2-picolylmethylamine, 2-(2-aminoethyl)pyridine, and methylbis(3-aminopropyl)amine with copper, nickel, cobalt(II), zinc, and cadmium ions and for tris-(2-aminoethyl)amine with zinc ion over the temperature range 10-40°. The formation constants for iron(II) were determined at 30° with 2-picolylamine and 2-picolylmethylamine, but formation constants were unobtainable for vanadium(II) with 2-picolylamine or for silver with any of the amines listed. The experimental procedure developed by McIntyre was used, in which systems with low concentrations of reagents are employed. The formation constants were calculated by the method of Block and McIntyre.

Stabilization due to dative pi bonding was shown by dividing the free energy of formation of a stepwise chelation reaction by the free energy of formation of an entirely protonated ligand. The denominator in such a ratio was used as a measure of the strength of the sigma bond in the chelation process, and thus a high ratio would indicate stabilization other than by sigma bonding. It was shown that the amines expected to show pi-bond stabilization had higher ratios than did similar amines which could not form pi bonds. However, no quantitative measure of the amount of such stabilization can be claimed for the method in its present state of development.

Thus it may be concluded that the effect of pi bonding may be demonstrated qualitatively through formation constant measurements.

The formation constants of methylbis(3-aminopropyl)-amine are lower than those reported for bis(3-aminopropyl)amine, in agreement with the trend noted generally that tertiary amines form less stable chelates than do secondary amines. Microfilm $2.45; Xerox $8.60. 186 pages.

CRYOSCOPY AND CONSTITUTION OF MOLTEN SALT MIXTURES IN THE LITHIUM CHLORIDE—POTASSIUM CHLORIDE EUTECTIC AND MERCURIC BROMIDE

(L. C. Card No. Mic 59-2927)

Jerome Goodkin, Ph.D.
Rensselaer Polytechnic Institute, 1959

Supervisor: George J. Janz

A calorimeter capable of measuring heats of fusion of inorganic salts to an accuracy of ± 2 per cent has been developed. The heats of fusion, entropies of fusion and the cryoscopic constant were determined for three inorganic salts. The values found in this study: 3200 ± 60 cal. $mole^{-1}$, 5.1 e.u., and 13.6 deg. $mole^{-1}$ $1000g^{-1}$ for the LiCl-KCl eutectic mixture; 2890 ± 60 cal. $mole^{-1}$, 5.9 e.u., and 27.2 deg. $mole^{-1}$ $1000g^{-1}$ for silver nitrate; and 4280 ± 80 cal. $mole^{-1}$, 8.4 e.u., and 43.8 deg. $mole^{-1}$ $1000g^{-1}$ for mercuric bromide, are recommended for thermodynamic and theoretical calculations for these systems.

The cryoscopy of the alkali halides in the LiCl-KCl eutectic mixture was extended to include the solutes LiF and KF. The results were examined in the light of the Temkin model for ionic melts. It is found that this model adequately describes the properties of NaCl, NaF, and KF in the chloride eutectic. The behavior of LiF in the chloride eutectic appears abnormal; the reason for the anomalous cryoscopic activity is not understood at this time.

A cryoscopic apparatus yielding reliable results for systems, such as the mercuric halides, having appreciably high vapor pressure at the melting point has been developed.

The complete series of alkali bromides and potassium chloride were studied in mercuric bromide. A model for mercuric bromide in the molten state was developed from a consideration of the various physical properties of this salt. The cryoscopic behavior of the above solutes can be explained in the light of this model by a simple primary dissociation to form free alkali cations.

The activity coefficients of mercuric bromide are found to be directly related to the nature of the cationic species of the solute. The equation:

$$\gamma_1 = \frac{-rm}{4} + C$$

where γ is the activity coefficient of mercuric bromide, r the radius of the cation, m the molality, and C a constant specific for each concentration, is found to fit these data. It is found from these results that the activity of mercuric bromide in any mixture of alkali bromides can be predicted from a knowledge of the radius of the cationic species and the concentration of the solute.

Microfilm $2.00; Xerox $6.80. 144 pages.

THE INFRARED ABSORPTION SPECTRA OF SOME SILICATES, ALUMINATES, AND OTHER COMPOUNDS OF INTEREST IN PORTLAND CEMENT CHEMISTRY

(L. C. Card No. Mic 59-2793)

Charles Maxwell Hunt, Ph.D.
University of Maryland, 1959

Supervisor: Professor Ellis R. Lippincott

Infrared absorption patterns in the 600 to 5000 cm^{-1} region for a number of compounds which are of interest in the chemistry of portland cement have been presented and discussed. The compounds studied include tricalcium silicate, beta and gamma dicalcium silicate, tricalcium aluminate, and tetracalcium aluminoferrite all taken before and after hydration, as well as calcium hydroxide, calcium carbonate, some calcium sulfoaluminate preparations, and a number of naturally occurring minerals in the CaO-SiO_2-H_2O system. Infrared measurements have potential value in characterizing these materials. They also cast some interesting sidelights on previous work in the field.

Microfilm $2.00; Xerox $4.40. 84 pages.

THE VIBRATIONAL SPECTRA AND GEOMETRICAL CONFIGURATION OF BIPHENYL

(L. C. Card No. Mic 59-2532)

John Edward Katon, Ph.D.
University of Maryland, 1958

Supervisor: Professor Ellis R. Lippincott

Many investigations aimed at determining the structure of biphenyl have been carried out. Although the molecule is now known to be colinear, the precise orientation of the rings with respect to each other is still unknown. An attempt has been made to determine this structural feature by the analysis of the vibrational spectra of biphenyl and decadeuterobiphenyl.

Decadeuterobiphenyl was prepared by exchange between biphenyl and calcium deuteroxide in a sealed tube at 480° C. The Raman spectra of the two compounds were obtained with the pure liquids and the infrared spectra were obtained with solutions of the compounds in various solvents.

There are three possible configurations of biphenyl corresponding to symmetry classifications D_{2h}, D_{2d}, and C_2. There is a fourth possibility of free or nearly free rotation. The observed spectra have been found to be consistent only with a D_{2h} model or a slightly hindered rotator.

The spectra have been assigned with the aid of the published assignments of benzene and monosubstituted benzenes and checked by use of the Redlich-Teller product rule. The spectra are similar to those of benzene, with which they are compared, except for the six new ring-ring modes which occur in biphenyl. The position of the ring-ring stretching frequency at 1275 $cm.^{-1}$ is explained on the basis of bond type and mass only. The differences in the observed spectra from those of benzene are thought to be due to substitution and mass effects only and the resonance interaction between the rings is felt to be small. The assignment is also compared with a previously published assignment of biphenyl.

It is of interest that an apparent violation of the non-crossing rule occurs in two of the vibrational species of the D_{2h} model. This has been explained in terms of a change in the essential character of the vibrations concerned upon isotopic substitution.

The thermodynamic functions of biphenyl have been calculated at various temperatures from the assignment. Comparison of the spectroscopic entropy with the calorimetric entropy at the boiling point indicates a potential barrier to internal rotation of the order of magnitude of 2 kcal./mole. This value must be considered to be only approximate due to various uncertainties in the assignment.

Microfilm $2.00; Xerox $5.40. 106 pages.

A STUDY OF THE REACTIONS OF ALKALI METALS WITH ALCOHOL IN LIQUID AMMONIA

(L. C. Card No. Mic 59-2686)

Eugene Joseph Kelly, Ph.D.
The University of Tennessee, 1959

Major Professor: Jerome F. Eastham

The kinetics of the reaction of an alkali metal with an alcohol in tritium-labeled liquid ammonia were investigated New apparatus and techniques were developed for this purpose. The experimental procedure involved quantitatively collecting the liberated hydrogen in consecutive, discrete increments throughout the course of the reaction. The volume and the specific activity of the hydrogen contained in each increment were then measured. These measurements were corrected for the effect of the reaction occurring between the alkali metal and the solvent. In addition, the initial concentrations of the reactants were known, and the specific activity of the solvent was measured.

It was observed that as the reaction between sodium or potassium with ethanol proceeded to completion, the specific activity of the liberated hydrogen varied continuously. These changes were particularly pronounced at 25 and 50 per cent completion of reaction. It was shown that the isotopic exchange reaction between the proton donor and the solvent was instantaneous relative to the rate at which hydrogen was liberated from the proton donor. Consequently, since the H/T ratio in the solvent remained constant throughout the reaction, the variation in the specific activity of the liberated hydrogen was attributed to a change in the nature of the proton donor.

On the basis of the preceding observations, a model for the reaction of sodium or potassium with ethanol in tritium-labeled liquid ammonia was proposed. This model assumes that one-fourth of the hydrogen initially present in the ethanol is liberated from C_2H_5OH. The next one-fourth of the hydrogen is liberated from an ethanol-ethoxide ion complex, $[(C_2H_5OH)_3 \cdot OC_2H_5]^-$, while the remaining half of the hydrogen is liberated from a second complex, $(C_2H_5OH \cdot OC_2H_5)^-$. The overall hydrogen evolution reaction was found to be first order in ethanol, but zero order in alkali metal. It was therefore concluded that the rate at which hydrogen was liberated was determined by the rates of dissociation of the proton donors to produce solvated protons. The solvated protons then react with the solvated electrons of the metal-ammonia solution to produce molecular hydrogen in a non-rate-determining reaction.

The overall rate of the hydrogen evolution reaction, although zero order in alkali metal, varied from one alkali metal to another. This variation was attributed to the differences in the interactions of the alkali metal ions with the proton donors. The reaction of lithium with ethanol was found to be abnormally fast compared to the corresponding sodium and potassium reactions, and to exhibit no change in the specific activity of the liberated hydrogen at 50 per cent completion of reaction. As a result, it was postulated that lithium did not react with a one to one ethanol-ethoxide ion complex, $(C_2H_5OH \cdot OC_2H_5)^-$. The absence of this reaction was attributed to the fact that lithium, with a high charge to radius ratio, might compete with the proton donor for the ethoxide ion and prevent the formation of this complex.

On the basis of the models proposed for the reactions of sodium or potassium and lithium with ethanol in tritium-labeled liquid ammonia, equations were derived which relate the total volume and the total activity of the liberated hydrogen to the reaction time and the values of the quantities at infinite reaction time. The experimental results were found to agree well with those predicted by the equations.

The reaction of potassium with isopropyl alcohol was also studied briefly and found to have a half-time approximately six times greater than the corresponding ethanol reaction.

The separation factor for the evolution of hydrogen from ethanol was found to vary from 1.5 to 3.1, depending on the alkali metal employed and on the per cent completion of reaction. The separation factor for the reaction of the alkali metals with the solvent was approximately 12.

Microfilm $2.25; Xerox $8.00. 172 pages.

PART I: POLYMERIZATION OF BUTADIENE WITH ZIEGLER-TYPE CATALYSTS. PART II: PREPARATION AND ATTEMPTED HYDROGENATION OF POLY(2,3-DICHLORO-BUTADIENE-1,3).

(L. C. Card No. Mic 59-1773)

Ti-Kang Kwei, Ph.D.
Polytechnic Institute of Brooklyn, 1959

Adviser: Herman F. Mark

The polymerization of butadiene-1,3 by a Ziegler-type catalyst containing triisobutylaluminum and titanium tetrachloride was studied. The effect of catalyst composition, temperature, and solvent on the percent trans-1,4 structure and the crystallinity of the resulting polymer was investigated. It was found that at room temperature, in heptane solvent, Al/Ti molar ratio of unity or less were suitable for the preparation of an all trans, crystalline polymer. In benzene, at room temperature, a polymer with over 80% trans structure could be prepared only when the Al/Ti molar ratio was less than 0.6. When the polymerization was carried out at 0°C, crystalline, all trans polybutadiene could be easily prepared in both heptane and benzene at an Al/Ti molar ratio less than 1.25.

The rate of polymerization was measured at 25°C in heptane by following the drop of butadiene pressure with time in a constant volume apparatus. The rate was a function of the Al/Ti molar ratio and was directly proportional to the amount of catalyst used. The rate of polymerization was proportional to the square of monomer pressure at Al/Ti ratios greater than 2.0.

$$-dP/dt = k_2 P^2 = k_2' P^2 (TiCl_4) = k_2'' P^2 (AlR_3)$$

When the molar ratio was between 1.0 and 1.6, the rate was proportional to the first power of the monomer pressure.

$$-dP/dt = k_1 P = k_1' P (TiCl_4) = k_1'' P (AlR_3)$$

At molar ratios of 1.8 and 1.9, the dependence of rate on monomer pressure could be represented by

$$-dP/dt = aP + bP^2$$

indicating the possible existence of two simultaneous reactions. When the ratio fell below unity the uptake of monomer was at first rapid but soon slowed to a stop.

Possible mechanisms of polymerization are discussed.

Attempts to prepare a head-to-head, tail-to-tail polyvinylchloride by the 1,4-polymerization of 2,3-dichlorobutadiene-1,3 followed by catalytic hydrogenation of the residual unsaturation were unsuccessful. Polymerization of 2,3-dichlorobutadiene-1,3 with free radical catalysts under various conditions gave polymers possessing a predominantly 1,2 structure. Attempted catalytic hydrogenation in the presence of platinum oxide, Raney nickel, or nickel-on-kieselguhr was unsuccessful.

Microfilm $2.00; Xerox $6.60. 136 pages.

THE ADSORPTION OF POLYDIMETHYL SILOXANES FROM SOLUTION ON SOLID SURFACES

(L. C. Card No. Mic 59-1776)

Robert J. Perkel, Ph.D.
Polytechnic Institute of Brooklyn, 1959

Adviser: Robert Ullman

This investigation was undertaken in order to study the adsorption of polydimethyl siloxanes on solid surfaces from solution. The adsorbents used were iron powder made from iron pentacarbonyl and pulverized pyrex glass powder, 325 mesh. Surface area measurements of the adsorbents were made by the fatty acid adsorption and nitrogen adsorption (BET) techniques. Adsorption measurements were made by differential infrared analysis using predetermined calibration curves.

It was established that no adsorption occurs from benzene and toluene (relatively poor solvents) on undried adsorbents, while measurable adsorption occurs from n-heptane and carbon tetrachloride (relatively good solvents) on undried adsorbents. Adsorption and desorption of polydimethyl siloxanes is more sensitive to water on iron powder than glass powder. The ratio of water to surface area determines the extent of adsorption in benzene. Reproducible adsorption is attainable by drying adsorbents at 300°C for three hours and stringent drying of solvents.

Equilibrium is established on dried iron in about thirty minutes and on dried glass in several minutes. The adsorption process on iron is accompanied by a transient phenomenon leading to the appearance and disappearance of carbonyl and C-O bond absorption peaks in the infrared spectrum. This has been identified with oxidation of the methyl groups of the polydimethyl siloxane to formaldehyde and polymers of formaldehyde. Oxidation in benzene solution probably leads to the formation of free radicals which cross-link and increase markedly the molecular weight of the polymer left in solution. Prolonged contact with glass also causes polymer degradation due to surface polymer exchange reactions.

The adsorption isotherms of methyl silicones do not conform to Langmuir isotherms. Initial slopes of the isotherms are much less steep than that of isotherms of carbon chain polymers with pendant polar groups, presumably because of shielding of the siloxane bonds by methyl groups,

and a greater configurational entropy change upon adsorption. Iron and glass exhibit equal affinity, but glass has a greater capacity for silicones (surface area by fatty acid method). Isotherms of polypentamethyl disiloxane methacrylate are intermediate between those of polydimethyl siloxanes and polymethyl methacrylate.

A dimeric homolog, hexamethyl siloxane, does not adsorb from benzene on glass or iron. Adsorption of high molecular weight polymer increased with increasing molecular weight in benzene and n-heptane on both surfaces. Molecular weight dependence conforms to the relation $A_\infty = K \overline{M}^a$, where A_∞ is the specific adsorption at saturation, $\overline{M}$ is the average molecular weight and K and a are constants. This is in agreement with the model of the adsorbed molecule which is bound by several segments along the chain, and with the remainder of the segments extending as loops into the supernatant solution. The affinity (initial slope of the isotherm) increases with molecular weight at high molecular weights.

Adsorption on glass from n-heptane is shown to be an exothermic reaction.

Solvent dependence of adsorption is shown to depend on the molecular size as well as molecular configuration and solvent-polymer, solvent-adsorbent interactions. In any group of solvents of approximately equal cohesive energy density adsorption decreases as the solvent power (intrinsic viscosity) becomes greater. A linear relationship is observed between cohesive energy density of the solvent and the saturation adsorption of methyl silicone polymer. The lower the cohesive energy density of the solvent, or the closer it is to that of the polymer, (54 cal/cc.) the greater is the observed saturation adsorption. Adsorption is inhibited by the presence of a solvent, such as acetonitrile, which exhibits strong preferential interaction with the adsorbent.

Desorption does not occur from glass from any solvent tried, except when water or acetonitrile was present. Marked desorption always occurred from iron with dried solvents, leading to desorption isotherms below the original adsorption isotherms. Desorption from iron is less in solvents in which water is less soluble.

Microfilm $2.70; Xerox $9.40. 207 pages.

ADSORBED MONOLAYERS OF ARGON, NITROGEN AND KRYPTON ON BORON NITRIDE AND ON A GRADED SERIES OF PARTIALLY GRAPHITIZED CARBON BLACKS

(L. C. Card No. Mic 59-2928)

Wallace William Pultz, Ph.D.
Rensselaer Polytechnic Institute, 1959

Supervisor: Sidney Ross

Low pressure adsorption isotherms of argon and nitrogen at 77.8° and 90.1°K. were measured on members of a graded series of a carbon black, which had been partially graphitized in an inert atmosphere at temperatures of 1000, 1500, 2000 and 2700°C. An increasing homogeneity of the surface accompanies graphitization, and is reflected in a number of adsorption phenomena, all of which gradually become more pronounced with increasing degree of surface homogeneity: (a) the two-dimensional van der Waals' equation provides a description of the isotherm over a greater range of surface concentrations; (b) the two-dimensional critical temperature of the adsorbate increases regularly toward the theoretical value expected of an ideally uniform substrate; (c) the mobilities of the adsorbed monolayers correspond over an increasingly greater range of surface concentration to that of a two-dimensional gas on a uniform substrate.

A sample of boron nitride was also used as adsorbent for monolayers of argon and nitrogen at 77.8° and 90.1°K. A comparison of the results for boron nitride with those for the carbon black series shows that the boron nitride surface would correspond to a carbon black of the present series graphitized at 1800°C.

Adsorption isotherms of krypton at 77.8° and 90.1°K. were measured on members of the same graded series of a carbon black and on the boron nitride sample. The critical temperatures of condensation of the adsorbate again demonstrates an increasing homogeneity with increasing temperature of graphitization for the carbon black. A vertical rising portion of the 77.8°K. krypton isotherm of boron nitride confirms a two-dimensional critical temperature of krypton equal to approximately 50% of its three-dimensional critical temperature.

Microfilm $2.00; Xerox $3.60. 65 pages.

INTRAMOLECULAR SPIN EXCHANGE IN SOME ORGANIC FREE RADICALS

(L. C. Card No. Mic 59-1748)

David Carroll Reitz, Ph.D.
Washington University, 1959

Chairman: S. I. Weissman

Four biradicals, Tschitschibabin's hydrocarbon, 1,2-bis-(4-diphenylmethylenylphenyl)-ethane, 4,4'-bis-(diphenylmethylenyl)-diphenylether, and 1,3-bis-(diphenylmethylenyl)-benzene, were prepared labelled with C^{13} nuclei at the methyl positions.

The C^{13} hyperfine spectra of these compounds were determined at a field of 3200 oersteds. The effects of concentration and temperature on the integrated paramagnetic resonance absorption indicate that the biradicals exist in equilibrium with diamagnetic molecules. The diamagnetic state was found to be lower in energy by several kcal. than the paramagnetic state.

The theoretical C^{13} hyperfine spectra of the biradicals were calculated as a function of the exchange rate of the two electrons. Comparison of the experimental and theoretical spectra leads to the conclusion that the exchange rate is much less than the C^{13} hyperfine interactions (expressed as a frequency).

Although the biradical molecules have a total electronic spin of 1, the weak interaction between the two halves of the molecules means that the two unpaired electrons are not in a triplet state, but rather that each unpaired electron is in a doublet state.

From these considerations it is concluded that the proton hyperfine spectra of the biradicals may be calculated from the spin densities determined for triphenylmethyl.

The proton hyperfine spectra calculated in this fashion agree with the experimentally determined spectra.

BIOGRAPHICAL DATA

Date of Birth:	March 26, 1932. Place of Birth: St. Louis, Missouri.
Undergraduate Study:	Washington University, 1951-1954.
Graduate Study:	Washington University, 1954-1958.
Scholastic and Professional Experience:	Research Assistant, Washington University, 1954-1955, 1957-1958; Teaching Assistant, Washington University, 1955-1957; Research Associate, Los Alamos Scientific Laboratory, Summer 1956.
Membership in Scholastic and Professional Societies:	Sigma Xi.
Honors:	University Remission of Tuition Scholarship, 1956-1957.
Publication:	D. C. Reitz and S. I. Weissman, Spin Exchange in a Biradical, J. Chem. Phys., 27, 968, (1957).

Microfilm $2.00; Xerox $4.20. 77 pages.

DISCHARGE-INDUCED REACTIONS OF BORON HALIDES WITH SOME NONMETALLIC OXIDES

(L. C. Card No. Mic 59-2911)

Richard Martin Rosenberg, Ph.D.
The Pennsylvania State University, 1959

The behavior of the trihalides of boron (except the triiodide) and of diboron tetrachloride (separately and in the presence of carbon monoxide) was investigated in an electric discharge. Reactions of trichloroborane with carbon dioxide, sulfur dioxide, and nitrogen were also studied. Ozonizer-type discharge tubes were employed operating at applied potentials of 10 kilovolts.

Discharges through the individual trihaloboranes produced relatively little change, and such reaction as did occur could usually be attributed to traces of adsorbed moisture on the discharge tube walls. Diboron tetrachloride, on the other hand, underwent disproportionation with the formation of equimolar amounts of trichloroborane and a dark-brown solid of empirical composition $(BCl)_n$. This solid is thought to be a pure substance, and, if such is the case, it is a member of the first reported pair of boron halide isomers (it is isomeric with B_4Cl_4).

In every system involving trichloroborane and a nonmetallic oxide, boron was deposited in the solid phase, in combination with oxygen. The trichloroborane-carbon monoxide reaction resulted in the formation of a nonvolatile deposit whose composition varied, according to the proportion of the reacting gases, from approximately one-to-one to approximately two-to-one in carbon monoxide to trichloroborane content. The solid discharge products, which were deposited on the tube walls as films, were separable into two fractions by extraction with isopentane. Boron was found exclusively in the isopentane-insoluble fraction. The absence of boron-to-boron linkages and the probable presence of boric anhydride were indicated by the results of experiments involving water and trimethylamine, respectively.

Discharges through mixtures of trichloroborane and carbon dioxide resulted in the deposition of a solid whose composition corresponded to a mixture of boric anhydride and trichloroboroxin. Carbon monoxide, phosgene, carbon tetrachloride, and chlorine were recovered as volatile products.

The widely differing results obtained from the two systems involving oxides of carbon were interpreted in terms of reactions of trichloroborane with the products obtained when carbon monoxide and carbon dioxide were discharged separately. In the former case, carbon suboxides were formed, while, in the latter case, discharge decomposition resulted in the formation of molecular oxygen.

The discharge-induced reaction between trichloroborane and sulfur dioxide was similar to the system trichloroborane-carbon dioxide, in that no sulfur was found in the solid phase. In this reaction, quantitative conversion of trichloroborane to boric anhydride was achieved. The volatile discharge products behaved as a mixture of sulfur dichloride and chlorine.

Discharges through mixtures of trifluoroborane and carbon monoxide, and tribromoborane and carbon monoxide resulted in the deposition of material somewhat different in nature from the trichloroborane-carbon monoxide product. In contrast to the latter product, the above-mentioned materials were of low thermal stability. Trifluoroborane was somewhat less, and tribromoborane somewhat more, reactive toward carbon monoxide.

Reaction of trichloroborane with nitrogen, in a discharge, was only slight.

A new method for the simultaneous determination of boron, carbon, and chlorine is reported.

Microfilm $2.10; Xerox $7.40. 160 pages.

MOLECULAR CONFORMATION OF CELLULOSE TRICAPROATE IN SOLUTION

(L. C. Card No. Mic 59-2388)

Leslie Howard Sperling, Ph.D.
Duke University, 1959

Supervisor: W. R. Krigbaum

The molecular conformation of the cellulosics has been the subject of several investigations. While the results indicate that cellulose esters in solution have an unusually high extension, the solution properties are as yet not well understood. Due to the crystallinity exhibited by most cellulosics, almost all of the investigations have been carried out in thermodynamically good solvents.

The present investigation combines osmometry, viscosity, and light-scattering to examine the dilute solution properties of cellulose tricaproate in several solvents. Due to the bulky substituents this polymer has a lower melting point, allowing measurements of the unperturbed dimensions under Flory theta conditions.

The results indicate that cellulose tricaproate is highly

extended in solution, and the molecular conformation does not approach a Gaussian distribution until the molecular weight reaches a few million. The intrinsic viscosity law:

$$[\eta] = K(\langle M \rangle_w)^{1/2} \quad (1)$$

is found to hold for this polymer in both good and poor solvents. The expansion factor is $\alpha \simeq 1.04$ in good solvents, independent of molecular weight. The constant K in equation (1) is found to be represented by:

$$K = \text{Const.} \cdot (R_e^2/M)^{3/2} \quad (2)$$

where R_e is the radius of an equivalent hydrodynamic sphere.

Finally, it is observed that the unperturbed dimensions of cellulose esters depend upon the optical dielectric constant of the solvent, n^2, the square of the index of refraction. Microfilm $2.00; Xerox $5.20. 104 pages.

A LOW TEMPERATURE NUCLEAR MAGNETIC RESONANCE STUDY OF FILMS OF CARBON TETRAFLUORIDE ADSORBED ON TITANIUM DIOXIDE

(L. C. Card No. Mic 59-2917)

Quayton Ray Stottlemyer, Ph.D.
The Pennsylvania State University, 1959

The Problem

This thesis is concerned with an investigation of the state of molecular motion and aggregation of adsorbed films of CF_4 on TiO_2 with respect to the number (or fractional number) of layers, from 9 layers to 0.20 layer, and to the temperature, in the range 20° K. to 90° K.

Procedure of the Investigation

Information towards the elucidation of the problem was obtained from the shape of bands in the nuclear magnetic resonance absorption spectrum of both the bulk CF_4 and the adsorbed molecules. Since the most readily detected effects on the gross structure of these bands are those due to changes in the molecular motion and those due to alterations in the distance of separation of the absorbing nuclei, a study of the line width behavior as a function of temperature and a comparison of the theoretical second moment of the absorption line, calculated according to Van Vleck's theory and modifications thereof, with the experimentally determined second moment have enabled the following conclusions to be drawn concerning the bulk CF_4 and the adsorbed films.

Conclusions

In bulk CF_4 from 20° to 60° K. the crystal lattice must be completely rigid for the experimental second moment, 13 gauss^2, agrees fairly well with the value of 12.0 gauss^2 calculated for a rigid polycrystalline lattice. In the region 60° to 65° K. the line width decreases from about 12 gauss to about 4.5 gauss. Second moment calculations indicate that some type of rotational motion must at 65° K. be present throughout the entire crystal lattice. Sharply at 76.2°K., coincident with the heat capacity lambda point, another transition was found in which migration develops for the entire crystal, for both the line width and the second moment fall to values close to those found for the liquid.

In the adsorbed films translational and rotational motion are retained at temperatures considerably lower than for the bulk material. In fact, below 0.8 layer there is no evidence for cessation of rotation of the molecules even at 20° K. The temperatures at which the two line width transitions were observed in the bulk CF_4 are, for the films, lowered, the amount being an inverse function of the number of layers down to 0.4 layer. For 0.2 layer the temperature is above that predicted by this inverse relationship.

For the adsorbed films, over some temperature range for a particular coverage, it is evident that two types of molecular motion are present simultaneously for different fractions of the molecules, the fraction of the molecules with the higher degrees of freedom becoming smaller as the temperature is lowered until it becomes zero at some fairly definite temperature.

Further details of the behavior have been correlated with a knowledge of the homogeneity of the TiO_2 surface and the number of layers of adsorbed CF_4. Although definite proof of patchwise adsorption was not obtained, all the evidence of this investigation is consistent with this theory and indicative of its essential correctness.

Microfilm $2.00; Xerox $5.00. 98 pages.

CHEMICAL EFFECTS IN AQUEOUS FERRIC OXALATE INDUCED BY GAMMA RADIATION

(L. C. Card No. Mic 59-2918)

John Wagner Swinnerton, Ph.D.
The Pennsylvania State University, 1959

In the past several years the effect of ionizing radiation of various kinds upon many aqueous systems has been studied. In the present investigation the effect of gamma radiation upon an acid solution of ferric oxalate was undertaken. The source of gamma radiation was the Pennsylvania State University research reactor. An operating reactor produces a copious supply of gamma radiation, thermal and fast neutrons. By conducting the irradiation in a container lined with cadmium placed six to eight fast neutron relaxation lengths from the reactor core, an essentially pure gamma ray dose was obtained.

The ferric oxalate solutions were studied under varying chemical conditions. These were: (1) varying acid concentrations using sulfuric acid, (2) stoichiometric 3:1 solutions containing three oxalate ions to one ferric ion, and (3) solutions containing other than stoichiometric 3:1 ratios.

Hydrogen, carbon dioxide, and ferrous ion are produced when ferric oxalate solutions are subjected to gamma radiation. The extent of the reaction was followed by analysis of these products. Ferrous ion was determined spectrophotometrically using a colorimetric method. The gaseous products, H_2 and CO_2, were determined with a General Electric mass spectrometer. It was also shown that no significant quantity of any other gaseous product is formed.

The effects of various additives were studied also, as was the effect of dose rate. $G(Fe^{2+})$ values, the number of ferrous ions produced per 100 ev. of energy absorbed, were determined for all the irradiated solutions. The Fricke chemical dosimeter was used in this investigation to measure the energy absorbed in the irradiated solutions.

A mechanism is proposed for gamma irradiated ferric

oxalate solutions. There were three variations on this mechanism which describe three distinct situations. These were: (1) solutions made up with ferric ammonium oxalate, (2) solutions containing an excess of ferric ion, and (3) solutions containing an excess of oxalate ion. The mechanisms were based on the primary radicals of water, H and OH, produced by ionizing radiation. These radicals are then thought to attack the various chemical species in the solution and ultimately result in the reduction of ferric ion, oxidation of oxalate ion, and production of hydrogen. In proposing the mechanisms for the reaction it was necessary to calculate various equilibrium concentrations of individual chemical species. The concentrations of the chemical species were calculated with the aid of a digital computer, PENNSTAC. Microfilm $2.25; Xerox $7.80. 169 pages.

THE TERNARY SYSTEM Ag_2S-Bi_2S_3-PbS

(L. C. Card No. Mic 59-2921)

Harry Jerrold Van Hook, Ph.D.
The Pennsylvania State University, 1959

The ternary system Ag_2S-Bi_2S_3-PbS has been studied by differential thermal analysis and by quenching experiments, using both polished sections and X-ray diffraction methods to identify the phases and to determine their solubility limits. All samples were sealed in evacuated silica-glass vials to prevent decomposition and oxidation at high temperatures.

In the binary system Bi-S, the compound Bi_2S_3 melts congruently at 760°C ± 5° under the pressure of the system which is estimated to be 1-5 atm. The results, on this system, together with information from the literature on the systems Pb-S and Ag-S, indicate that ternary mixtures of these sulfides can be studied essentially as condensed systems at the vapor pressure of the system if care is taken to minimize the free space above the charge in the glass vials.

Two compounds were found in the binary system Ag_2S-Bi_2S_3. Cubic $\alpha AgBiS_2$ (αmatildite) melts congruently at 801°C ± 5° and shows extensive binary solubility of both Ag_2S and Bi_2S_3 at high temperatures. At 195°C ± 5° this phase transforms reversibly to a low-temperature modification ($\beta AgBiS_2$) which compares essentially with previous X-ray data on βmatildite. A second monoclinic phase ($Ag_2S \cdot 3Bi_2S_3$) has been synthesized and studied by single crystal methods. This new compound has no known natural counterpart.

The solubility of Ag_2S in PbS is 0.4 mol % at 700°C whereas that of Bi_2S_3 in PbS is 9 mol % at the PbS-Bi_2S_3 eutectic (800°C). Addition of both Bi_2S_3 and Ag_2S greatly increases the solubility until the join $AgBiS_2$-PbS is reached where solid solution is complete. Solid solution is also extensive on either side of the $AgBiS_2$-PbS join at high temperatures, but decreases rapidly with falling temperature. The ternary solid solutions are further restricted below the intersection of the solvus which arises from the inversion in $\alpha AgBiS_2$ solid solutions to the β form. The decrease in solubility produces the unmixing textures observed in natural intergrowths. At 170°C, a maximum of 10 mol % $AgBiS_2$ may be held in the galena phase in equilibrium with $\beta AgBiS_2$--a fact which can be correlated with data on natural intergrowths of these two minerals.

It is concluded that the solubility of silver in galena may be extensive, even at low temperatures, when bismuth is present. A similar relationship in the system Ag_2S-Sb_2S_3-PbS is suggested by the available information on miargyrite ($AgSbS_2$). These observations afford a possible explanation for the common occurrence of Ag, Bi, and Sb in natural galenas.

Microfilm $2.00; Xerox $5.20. 105 pages.

THE SOLID SOLUTION ARGON - KRYPTON

(L. C. Card No. Mic 59-2213)

Joseph Frederick Walling, Ph.D.
University of Washington, 1959

Chairman: G. D. Halsey, Jr.

STATIC VAPOR PRESSURE MEASUREMENTS ON THE SOLID SOLUTION ARGON – KRYPTON

The solid solution argon – krypton has been studied by measuring the total pressure over the solid phase and analyzing the composition of the solid mathematically.

The random mixing approximation to the strictly regular solution theory of Fowler and Guggenheim was not satisfactory for describing the system. When modified to allow w_{AB} to be a function of temperature, however, it was found satisfactory.

By comparison with the parameters which characterize the solid solution krypton – xenon, it was determined that these solutions obey a corresponding states principle.

FROST POINT STUDY OF THE SOLID SOLUTION ARGON - KRYPTON

A frost point method was developed to study mixtures more dilute than could be effectively handled by the static vapor pressure method.

As precision was increased, it became possible to see an apparent composition dependence of the parameter w_{AB} in addition to the temperature coefficient. The theory has been modified in an empirical fashion to account for this effect. The modified expressions are compared with others obtained from a cluster sum treatment of the Ising problem by Rushbrooke and Scoins. On this basis, theoretical estimates of the mole fraction derivatives are made.

Consideration of the recent theory of Karasz and Halsey leads to the conclusion that in the infinitely dilute solution the increase in the free volume of the solute is essentially responsible for a non-zero value of the parameter s^o.

Microfilm $2.00; Xerox $3.80. 70 pages.

TRANSITIONS BETWEEN COLLAGEN AND GELATIN IN DILUTE AQUEOUS SOLUTIONS

(L. C. Card No. Mic 59-2959)

Edwin Snell Weaver, Ph.D.
Cornell University, 1959

A process analogous to the familiar thermal contraction of collagen is shown to exist in dilute aqueous solutions. As the temperature of such a solution is raised, the intrinsic viscosity of the solution changes abruptly from 90 to 1 dl/g in the narrow temperature range 35 to 40°C. Similarly the specific rotation of the solution changes from a native value of -344 to -131 in the same temperature range. As the transition in bulk collagen is known to be reversible, so is the transformation in dilute solution. If a solution heated above 40°C is cooled to 20°C, its optical rotation and viscosity change toward the values characteristic of the native solution. This reversibility, along with the observation that the transformation temperatures of both native solutions and solutions heated and then cooled for extensive periods are the same, leads to the conclusion that the collagen-gelatin transition is similar to a phase change, most probably of the helix-coil type. Further evidence for describing the transition in this manner comes from the kinetic measurements reported in this thesis. The rate of transformation appears to be independent of concentration and has a very large temperature coefficient in the transformation range; the rate of transformation increases 130 fold from 35 to 40°C. This large temperature coefficient together with the existence of reversion only a few degrees below the transformation temperature makes the characterization of the collagen-gelatin transition as a chemical reaction unrealistic. Further, the kinetics of the reversion have been studied viscometrically and polarimetrically in the range 5 to 23°C, and it has been found that the rate of reversion has a strong negative temperature coefficient. The rates of reversion follow two-dimensional nucleation theory; the logarithm of the half-times for reversion are linear with $1/T\Delta T$, where ΔT is the difference between the transformation temperature and the temperature of observation. In addition, the rate of reversion and the transformation temperature are both independent of collagen concentration. These findings cast serious doubt on the currently held views of the structure of the collagen protofibril. In particular, they favor a protofibril of only one chain, in contrast to the three chains required by several popular models.

Microfilm $2.00; Xerox $4.80. 95 pages.

FLOW PROPERTIES OF ALUMINUM DILAURATE-TOLUENE GELS

(L. C. Card No. Mic 59-2930)

Neill Weber, Ph.D.
Rensselaer Polytechnic Institute, 1956

Supervisor: Walter H. Bauer

Flow properties of aluminum dilaurate in toluene gels at 25° have been studied in a pressure capillary viscometer over a range of mean rate of shear from 10^{-3} to 10^{-6} sec.$^{-1}$. For high rate of shear studies, a pressure viscometer was modified to permit rapid automatic measurement of volume of efflux. Flow curves, mean rate of shear versus wall shearing stress, obtained for gels of 1,2,3,5 and 8% soap in toluene, showed three types of flow. A region of Newtonian flow with high viscosity was found at shear rates below 10^{-2} sec.$^{-1}$. When a critical shear stress range was exceeded, the shear rate rapidly increased with small increase in shear stress. At shear rates above 100 sec.$^{-1}$, a third regime of flow was found in which a plot of log shear rate versus log shear stress approached a constant slope, always greater than unity, and the flow curve was a marked function of the length to radius ratio of the capillary used. The shear modulus of elasticity and the viscosity were measured for 2,3 and 5% weight per cent aluminum dilaurate gels in toluene at shear rates below 10^{-2} sec.$^{-1}$. Similar studies were made on gels of aluminum 3,5-dimethylhexanoate, 1.5 and 2% by weight in toluene. Properties of the gels studied were found to be consistent with proposed structures of aluminum soaps. Entrance effects were found to be very important at higher rates of shear, and an analytical method for determining the "real" rate of shear versus shearing stress flow curve was proposed, and applied to the data obtained.

Microfilm $2.00; Xerox $5.20. 103 pages.

ECONOMICS, GENERAL

OPPORTUNITIES AND PROBLEMS OF USING UNITED STATES SURPLUS FOOD TO INCREASE CAPITAL FORMATION IN UNDERDEVELOPED COUNTRIES

(L. C. Card No. Mic 59-2763)

Ali Ahmed Attiga, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Raymond J. Penn

Statement of the Problem

During the past several years total agricultural production in the United States has averaged about 8 per cent above normal exports and domestic consumption. Wheat, cotton and feedgrains represent the largest portion of this excess production, followed by fats, oil seeds and manufactured dairy products. Judging from all available data it appears that the present imbalance will continue for the next five to ten years, if not longer. Present agricultural surpluses represent a total inventory of nearly 9 billion dollars.

Many underdeveloped countries are suffering from insufficient food supplies, capital funds and technical knowledge with which to develop their human and physical resources. In addition to this basic feature of many underdeveloped countries, their economies are usually characterized by substantial amounts of underemployment and unemployment in both the rural and urban sectors. The central problem of this thesis is to identify and examine the opportunities and limitations of using United States Surplus food as a source of capital funds with which to employ existing "surplus" labor in various capital forming activities.

Procedure

The main questions raised in this thesis are where, how and under what conditions may surplus food be used to contribute to capital formation in underdeveloped countries, without disrupting the world patterns of agricultural trade or adversely affecting domestic agricultural production and prices in these countries. Special emphasis are placed on the problems and objectives of present surplus disposal and their relations to economic development. The theoretical ideas and assumptions regarding the requirements of economic development, the role of surplus food in such development and United States interest in the progress of underdeveloped countries are analyzed in Chapters I through III. This analysis provides the bases for our evaluation of present methods of surplus disposal and foreign currency loans.

Results and Conclusions

It seems evident, from our analysis, that the only feasible way in which surplus food may be used to increase capital formation in underdeveloped countries, without serious interference with their existing levels of food production or imports, is by coordinating the rate of surplus disposal to the rate of additional consumptive capacity which will be created by raising the level of per capita income through increased economic activities, employment and productivity. In this process surplus food may be regarded as a source of capital funds and consumer goods.

The extent to which this can be done depends on the nature and magnitude of under and unemployment, the kind and extent of undernourishment among the laborers and their dependents, and the relative need of an economy for various social overhead facilities which can be built with labor intensive techniques. On the bases of these variables it is safe to conclude that there are some promising opportunities for using surplus food to increase capital formation in several food deficit underdeveloped countries. It is evident that the speed with which these opportunities are exploited will depend on the quality and efficiency of various administrative and technical procedures used to channel surplus food from the Commodity Credit Corporation into capital forming activities in underdeveloped countries. Our analysis provides ample evidence to support the conclusion that some significant changes will have to be made in the existing methods of surplus disposal before they can effectively serve the theoretical and practical requirements of using surplus food for capital formation, as formulated in this thesis. Microfilm $3.40; Xerox $11.60. 263 pages.

THE EFFECT OF PRICE ON THE SUPPLY RESPONSE OF MILK IN TWO OHIO MARKETS

(L. C. Card No. Mic 59-2733)

Dale Herbert Carley, Ph.D.
The Ohio State University, 1959

Considerable concern has been expressed about the accumulation of an excess supply of milk in certain Ohio markets, since the element of risk involved in its handling can disrupt the entire market structure.

One approach to the alleviation of the problem is to rearrange or modify the pricing structure. The purpose of this study was to determine the degree of relationship of price and supply for milk within the present pricing structure.

A study was made first, of Federal Order provisions as they changed price and, then, of the result of the price change on supply in a future period. Three provisions were specified as price-moving provisions: the Class I differentials, seasonal pricing plans, and supply-demand adjusters. The markets of Dayton-Springfield and Cleveland were considered representative of Ohio marketing conditions and were used as a basis for study.

In order to gain uniformity in the data, the effect of the price level, seasonality, and trend were taken into account. The markets were compared to determine the similarities

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

or differences resulting from the operation of the various provisions.

Average daily deliveries were increasing in both markets at a rate in excess of 6 per cent per year. At the same time, producer blend price remained relatively steady. In the latter years production within any one year was becoming more level. This was an indication that price differences within one year were bringing about supply changes.

Three types of seasonal pricing plans were used in the two markets: the seasonal variation in the Class I differentials, the Louisville fall premium plan, and the base-excess plan. The seasonal variation in the Class I differential brought about a change in the seasonal production pattern when the difference between the spring and fall price was of the magnitude of 60 to 90 cents per hundredweight.

Producers in the Cleveland market reacted to the base-surplus plan almost immediately after its adoption. Within the first three years of use, producer deliveries in the fall months changed from 88 per cent to 97 per cent of the 12-month moving average. Spring deliveries changed from 118 per cent to 112 per cent of the moving average. The difference of $1.25 per hundredweight between the price for the base milk and the excess milk probably was the greatest factor contributing to the change in the pattern.

The Louisville fall premium plan used in the Dayton-Springfield market brought about a more level production pattern; however, the response to this type of plan was slower and more gradual than the response to the plan used in Cleveland. In both markets the month of lowest delivery shifted from November to August.

An individual producer attempting to take advantage of either plan would develop a different production pattern. Under the base-excess plan the producer with a relatively level production pattern would benefit most; the producer to benefit most under the Lousville plan would acquire a production pattern contra-seasonal to the market.

There was some question of the effectiveness of the supply-demand adjuster provision in adjusting price to offset maladjustments between the supply and demand for milk. In Cleveland the price was adjusted downward two-thirds of the time, yet supplies continued to increase. The adjuster worked contra-seasonal to the seasonal incentive plans in some years for both markets. It was concluded that the amount of monthly price adjustment was not great enough to bring about significant changes in the supply of milk.

The short-run response of supply to price was found to be quite low. Variables such as the milk-feed ratio and beef prices were found to be as important as price in explaining short-run supply responses.

Microfilm $2.00; Xerox $5.80. 117 pages.

A CASE STUDY IN THE RELATIONSHIP OF JOB CONTENT TO WAGE DISPERSION

(L. C. Card No. Mic 59-2713)

Virgil Charles Crisafulli, Ph.D.
The Ohio State University, 1954

The Problem

The marginal productivity theory of wage postulates that given the conditions assumed in the theoretical model of the competitive market, wages for the same grade of labor will level up to a single amount in its long run market. Differences in wage rates for the same work can exist only as a short run phenomenon and only as long as the conditions of competition assumed in the theoretical market do not exist in actuality.

Empirical evidence reveals the widespread existence of a range of rates instead of a single rate at any given time. Further study has shown that these different rates are not merely short run aberrations but represent the permanent long run structure of wages.[1] The question that arises is, To what may be attributed the existence of such differences in the rates for the same work in the same market?

If we accept the conclusions of the work of Professor Lloyd Reynolds, then we know that the differences instead of being short run deviations from a long run norm are themselves the norm. In such a case either we must discard the orthodox theory of wages and offer a different one or we must probe further for an explanation of the differences. Logically we must examine or re-examine the conditions in the market which are the efficient sources of dispersion rather than uniformity in wages. Such conditions cannot but arise from a lack of correspondence between those assumed in our current theory and the actualities of the market.

Among these conditions the most important ones are (1) unresolved differences in the value of the marginal product of workers in different industries; (2) differences in, rather than homogeneity of, the quality and effort of workers; (3) differences in, rather than homogeneity of, the content of the jobs in different establishments.

The dissertation is concerned with the third source of differences in wage rates. It is a study of jobs and market wages. As such it attempts to show to what extent differences in wages are due to differences in jobs normally assumed to be identical. It is a well-known fact that job titles are misleading indicators of the work content of jobs. If these differences in the content of jobs and the amount of wages are correlated so that we might isolate that proportion of such difference in wage rate attributable to a difference in amount of work, it should be possible to show that the true difference in wage rate is less than appears. Furthermore, it should be possible to show by what amount it is less.

Also, the answer to the question, What proportion of the total difference in wage rate may be assigned to the non-existence of job homogeneity? will at the same time stand as a definition of the importance of the assumption of homogeneity of jobs in wage determination.

Scientific Method

The research approach employed for isolating and measuring the relationship of job homogeneity and market wages involved traditional empirical method. Questionnaires and statistical table forms for compiling information suitable to the problem were devised. The data were gathered directly by the use of the method of personal conference between the author and personnel directors of the fifteen firms surveyed.

An element of originality in the use of tools for economic research was introduced by the employment of the technique of job analysis developed by industrial management.

The job analysis system built for this study is the

product of existing, nationally-known job evaluation systems. The systems of the National Metal Trades Association, the National Founders Association, the Industrial Engineering Society, several specific company systems, and, of course, textbook systems were examined and adapted to a system specially designed to serve the purpose of this investigation.

The final one constructed carries a point weighting scheme for the component elements of jobs which is identical to that of the National Metal Trades Association. This weighting is 50 per cent for skill factors; 15 per cent for effort; 20 per cent for responsibility; and 15 per cent for working conditions. Ten general job factors were chosen as components of these four major categories and they were assigned point values reflecting the above weighting at four levels of demand that particular jobs might make upon any of them.

The use of a point system to measure job content made it possible to correlate amounts of job with amounts of wages. In other words, it made it possible to measure what proportion of wages should be discarded as not being pay for the same work.

Certain obstacles presented themselves which a priori threatened the validity of the approach. These had to do with consistency in plant to plant rating of similar jobs, the choice of proper "weights" for the job factors, and the subconscious tendency of raters to give high points to highly paid jobs and low points to lowly paid jobs. All these were corrected for by the use of job descriptions, the strict schooling of raters, and the author's presence, as a kind of guardian of objectivity during all the work of rating. The problem of weights was handled by following prevailing practice as stated above.

In the final analysis validity in economics is to an extent a matter of human agreement, and such agreement, tacit or explicit, is the most important inherent element of customary practice. It will be seen below that the results of analysis justified this faith in customary practice. The weights for the job factors and the inter-plant comparisons are the two major weaknesses of job evaluation as a tool for economic research. Fortunately, neither of them operated against the interests of truth in the final analysis.

Another aspect of scientific method concerns the qualitative and quantitative adequacy of the data. The sample of information analyzed must be representative. When subjected to seven or eight major criteria of representativeness, the sample was found to be valid. Among these were several considerations which might be defined as essential.

First, the jobs must be truly inter-industry and must be found in all or most fields of manufacturing or the results could not be called a test of market wage theory. The 15 firms in this sample span 15 different specific fields of manufacturing -- from food to steel products; they include old and new firms, large and small firms (the very smallest could not be represented), and unionized and non-unionized firms (but predominantly unionized ones).

Second, the jobs must be numerous enough to be representative of all skill levels. Through a process of elimination 27 jobs were selected for the field work, of which a final sample of 21 jobs survived, half of which are maintenance jobs. The 21 jobs, of which 14 have eight to 15 observations, include virtually all the jobs which exist in all industries in this market.

Results

The results may be summarized under the following seven analytical steps.

First, a preliminary analysis of the various wage units was made in order to find which might be the best for an analysis of wage rate differences. Of the several distinct units available, the average straight-time earnings for each job qualified best. Any other wage unit presented complications for inter-firm comparisons.

The second step was to determine the effect of fringe benefit payments upon base earnings. It is a current belief among economists that higher paying firms also pay greater fringe benefits. This would mean that true differences in wages for the same work are greater than appears. On the basis of the findings in this study this is an erroneous notion.

The findings in this study support previous indications in the New Haven study. The index of rank correlation was computed for fringe payments and gross earnings and for starting rates. For gross earnings (plant-wide) this came to +0.054, compared to Reynolds' finding of +0.17. For starting rates the present sample showed -0.013, whereas Reynolds found +0.15. Thus the conclusion which Professor Reynolds did not feel confident in drawing may on this additional evidence be stated: Higher paying firms generally pay absolutely greater fringe payments than lower paying firms but not enough greater to widen wage differences.

This becomes one of the basic contributions of this study. It means that wage relationships may be studied without undertaking the labor of pinning down the exact value of fringe payments or qualifying conclusions in this regard. The fringe benefits would have to amount to more than the 8 per cent of base earnings found in this study -- perhaps as much as 25 per cent of the total wage -- to affect inter-firm dispersion.

The third step in the analysis was to examine the nature and extent of wage differences. This is shown through the computation of several measures of relative dispersion: the total dispersion, which is the range stated in percentage terms; the dispersion of the inter-quartile range measured as a ratio of the median $\frac{Q_3 - Q_1}{Md} 100$; and the coefficient of variation based on the standard deviation (V_σ).

The data show the highest starting rate to be 61.2 per cent higher than the lowest. For the New Haven sample this was 58.2 per cent. The dispersion of the inter-quartile range is 24.0 per cent for the present sample and 18.9 per cent for the New Haven sample.

The plant-wide averages reveal an interesting relationship. Straight-time earnings span 79.2 per cent, low to high, with a median of 41.1 per cent, but the average gross earnings have a total distance of only 49.7 per cent, low to high, and the median is only 14.7 per cent higher than the low. This closing of the range by about 30 per cent, most of it through an increase of the lower paying firms, means that the real dispersion is less than straight-time earnings indicate.

The dispersion measured by the formula $\frac{Q_3 - Q_1}{Md} 100$ is 18.8 per cent for the plant-wide average straight-time earnings and 17.7 per cent for the plant-wide average gross earnings. For the New Haven sample, in which "average earnings" is interpreted as "gross," this index of dispersion

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is 16.1 per cent. It appears from this and other studies that as a general rule dispersion as measured by this method ranges from about 10 to 30 per cent for most jobs and most markets. Calculations for individual jobs agree with these plant-wide average indications.

The calculations of total range dispersion, low to high, for the individual jobs range from 20.3 per cent for Heavy Truck Driver to 82.3 per cent for Multiple Spindle Drill Press Operator. There is some bunching when the percentage ranges are arrayed. The middle 50 per cent of the values lie between 38 and 59 per cent, a span of 21 points, whereas the lowest and highest 25 per cent spread over twice the distance.

A conclusion here, therefore, is that total percentage dispersion of market wages shows the highest rate for most jobs to be from 38 to 59 per cent higher than the lowest. The median is 49.7 per cent, which also happens to be the value for the total percentage range for plant-wide average gross earnings for these 15 firms.

The fourth step in the analysis concerned the spread of the middle 50 per cent of each array for the individual jobs. Measured as a ratio of the median for comparison with other studies, values of 9.1 to 50.0 per cent resulted when all jobs were included, but this became 9.1 to 30.0 per cent when only the 14 jobs with eight to 15 observations were selected. The median for the latter was 22 per cent and the values concentrated between 20 and 27 per cent. There is slight evidence that the true index of dispersion lies closer to the upper values -- possibly 25 per cent -- than it does to the lower values of 20 per cent or less, since an array of these indices on the basis of number of observations finds more values above the median of 22.6 per cent as the number of observations increases. On the other hand, no pattern such as Robert Raimon found from the Bureau of Labor Statistics data is observable when the jobs are grouped as skilled, semiskilled, and unskilled.

A fifth step in the analysis was taken as a check on these calculations by the application of the coefficient of variation based on the standard deviations (V_σ). The values ranged from 8.6 to 19.5 per cent with a median of 13.5 per cent. Except that this measure seems to be about 60 per cent as large as the previous one, no particular significance is attached to it. The rank order of the jobs for $V\sigma$ values is little different. The net gain seems to have been a check on the other measure.

In the sixth step the content of the jobs as expressed by point scores was associated with the average straight-time earnings for each job. To get a view of correlation, the coefficient of rank correlation for each job was computed at two levels of variation. At the surface level, the "absolute" number of points for each job and its wage were associated. The results shown in Table I are considered untrustworthy because of the weaknesses mentioned above regarding inconsistency in plant to plant rating of jobs.

The more trustworthy correlations are those in which the deviations from a mean of points and wages for each job were associated. This method gets around the weakness of conservative and liberal raters and plant to plant inconsistency.

The answers in each case show a very wide range of variation: from -0.91 to +0.71 for absolute variations and -0.96 to +0.80 for relative variations.

The following table shows the arrays of both absolute and relative measurements broken down.

TABLE I

Arrays of Coefficients of Rank Correlation for Absolute Job Points and Earnings and Relative Job Points and Earnings Relationships.

Measure	Absolute	Relative
Range (-1.0 to +1.0)	-0.91 - +0.71	-0.96 - +0.80
First Quartile	-0.71	+0.11
Median	+0.30	+0.23
Third Quartile	+0.46	+0.47
Q_3-Q_1	1.17	0.36

The arrays agree for the medians and third quartiles but are far apart in the first quartile index. The coefficients for absolutes are so chaotic that it seems better to abandon them.

The more important variations, those of the deviations, are more consistent. Though the range is wider, there is a good concentration around the median value of +0.23. Further, 75 per cent of the cases show less than +0.47 rank correlation, and 50 per cent are below +0.23. The conclusion is that little or no correlation is indicated.

The seventh and final step was to regroup the sample of jobs into skill groups objectively determined by the point scoring system. The job ratings yielded natural skill groupings at 15 points on the scale from 100 to 600 points. Therefore, the 21 jobs were reduced to these 15 skill groups. The earnings for each group were arrayed and total percentage range and inter-quartile dispersion were computed. There was no significant difference in dispersion.

These skill groups were numbered I to XV from lowest to highest. The percentage which the highest wage bears to the lowest ranges from 24.8 per cent for skill group XIII to 120.8 per cent for skill group IV, compared to 20.3 per cent lowest and 82.3 per cent highest for individual jobs.

Finally, the dispersion of the inter-quartile range was compared. For the 14 individual jobs with eight or more observations this ranged from 9.1 to 30.0 per cent. For the skill groups it ranged from 8.0 to 35.8 per cent. This is so close that it calls for careful attention.

The final analysis of wage differences and job content shows that the differences do not narrow when jobs are regrouped according to objectively determined skill groups. Jobs by the same title do differ in content -- often by more than 50 per cent -- but these differences do not correlate with rate differences.

Very probably job content is in some small way associated with wage differences, but the association is so small that more powerful wage determiners overwhelm the role of job content. These more powerful forces can only be differences in the market value of the product between firms (ability to pay) and differences in the quality and effort of workers.

Microfilm $4.35; Xerox $14.60. 340 pages.

1. Reynolds, Lloyd G. The Structure of Labor Markets. New York: Harper & Brothers, 1951, p. 190.

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GOVERNMENT POLICY IN SITDOWN STRIKES

(L. C. Card No. Mic 59-2579)

Walter L. Eisenberg, Ph.D.
Columbia University, 1959

From ancient times forward men have signified their discontents while working for others, regardless of the rigidity of the ties binding them to the work, by simply refusing to continue to work. While the refusal to work is itself a changeless phenomenon, the means adopted to dramatize the refusal are not.

Only within recent decades have some of the patterns adopted by employees for bringing the work process to a temporary halt been institutionalized and cloaked broadly with the sanction of law. Despite the growth of governmental and business acceptance of union activity, needless to say, not all of the attempts to establish a new employee tactic as a standard device of group action have been successful, in whole or even in part. The sitdown strike is an example of one such unsuccessful attempt. Yet, the failure of the sitdown tactic to survive a period of extensive use in the 1930's is not the measure of its significance in the history of American trade unionism. Its significance lay, in part, in its contribution to the acceptance by employers of employee self-organization and collective bargaining. It, also, helped to assure the establishment of the United Auto Workers (UAW) as a powerful industrial union; facilitated the break of the Committee for Industrial Organization (CIO) with its parent organization, the American Federation of Labor (AFL); enlarged union membership; and helped produce specific economic gains for employees.

The first prominent sitdowns of the 1930's emboldened many unionists and discouraged many others, exhilarated employees, irritated and dismayed employers, confounded public officials, provoked strenuous debate among lawyers, legislators, and intellectuals generally, and sent the imaginations of left- and right-wing political extremists soaring.

The walkout type of strike which had been used in almost all of the major labor relations disputes between the mid-1870's and the mid-1930's, and had yielded such a modest rate of success, deservedly survived as an economic weapon for unions. Yet the sitdown of the mid-1930's which was used so extensively and with such a modest rate of failure, deservedly perished in the infancy of its popularity.

The problem posed for government by the sitdown was extraordinarily complex. It was the sort of problem faced by any democratically organized society when a large and determined group within the community decides to disobey flagrantly the most traditionally entrenched of its laws, in this instance those safeguarding property. The sitdown was deemed clearly illegal under a variety of existing laws, none of which had been enacted against the sitdown per se. But some lawyers for sitdowners and their supporters argued that a stage of initial illegality characterized the experience of all of the other tactics used by unions at one time or another. While it is true that the voluntary associations of employees, their objectives, and their methods had each from their inception been called in question in courts of law, none of the other tactics which had eventually been validated involved the physical seizure of business premises and equipment. Previously established rights for employees had been constructed out of limitations on the property rights of employers, but an American workingman was hard pressed, in any attempt to extend these, to justify a claim for a right built around the physical seizure of his place in the employer's factory against the employer's will. The efforts to do so taxed the ingenuity of those who believed the sitdown a boon to the future as well as to the present of labor unions. These arguments were, on balance, quite specious and the courts held firm in their view of the lawless character of the tactic.

It was in this area of implementation of court viewpoint and decisions that the problem took on its aspects for frustration for public authorities. The conduct in a sitdown having been declared lawless, means for putting an end to the conduct so declared, still remained to be devised. Moreover, the matter of punishment for this kind of wrongdoing required decision, too, if future use of the tactic was to be deterred. With the successful organization of the newer industrial unions and the solidification of the representational and bargaining positions of the older unions, those in government contemplating anti-sitdown policies eventually came to have unexpected and powerful allies. Union leaders could not afford to have their members regard the sitdown as a standard tactic with which to approach labor-management problems. The ease with which small groups of union members uncontrolled by union officers or delegates could launch and maintain a sitdown represented as much a threat to the union's orderly administration of its affairs as it was to management's orderly conduct of its business.

Curbing the sitdown was a difficult task. Its appeal to hitherto unorganized workers in vigorously anti-union industries was great. A sitdown could be conducted with a handful of the employees of any establishment, and could be won with people who joined the union after the strike rather than before. It served to do in abrupt fashion what a walkout and picketing might or might not do; it choked off the supply of labor. The employer was foreclosed from physical replacement of the strikers. Even employees who had no inclination to participate in the strike typically made no attempt to go back to work while the strikers remained within the place of work.

Despite these characteristics, the sitdown came gradually but surely into widespread disfavor, resulting in its abandonment by responsible organized labor; the typical exceptions being small, desperate, left-wing, or splinter-union groups of employees unable to conduct a successful walkout. Microfilm $5.00; Xerox $16.60. 389 pages.

AN EXPERIMENTAL STUDY OF GROUP REACTION TO TWO TYPES OF CONFERENCE LEADERSHIP

(L. C. Card No. Mic 59-2716)

William McNair Fox, Ph.D.
The Ohio State University, 1954

INTRODUCTION

Data from relevant surveys and investigations suggest that the decision making conference process has much to offer to modern business organizations and other types of organizations if it is properly developed and utilized. It has been reported that conferences consume from a quarter to one-half of the average executive's time, yet little is known experimentally of the most effective techniques for

conducting them. Surveys of the literature pertaining to conference process have revealed an overwhelming emphasis upon the experiential or conceptual approach. The typical author relies upon feelings or hunches that he has derived from limited experience with the conference method. At best, he is an academician who theorizes about the dynamics of participation in an attempt to provide problems for actual study and experimentation. In the "wisdom" literature a converse could be found for almost every assertion.

REVIEW OF PAST EXPERIMENTATION

In order to ascertain what had been done previously, a comprehensive search of the literature was made for studies which were generally similar in purpose or design to the present study. Among others, the work of such pioneer experimenters as Lewin and Lippitt, and those who have engaged in conference research at the University of Michigan, was reviewed. This examination confirmed the need for additional experimentation to validly ascertain the factors which account for effective conference leadership. In their special report of March, 1950, on "Process of the Administrative Conference," the Michigan staff members write:

"It seems clear at this time that future study should be concerned with attempts at manipulation, either in the laboratory or in the field, of those variables which seem important in accounting for appreciable portions of the outcome variance. The relationships discovered have been associational in nature; it is necessary to demonstrate by experimentation that the process variables actually do produce the conference outcomes with which they are correlated. Such studies might take the form of laboratory experiments in which one variable is changed at a single time; they might also take the form of field studies, in which observations are made before and after the leader is trained in accordance with procedures suggested by the findings obtained to date."

OBJECTIVES AND SCOPE OF THE STUDY

The dissertation was prompted by a desire to obtain more adequate experimental data for such questions as the following:

1. Is it possible to place a conference group in a controlled, experimental environment without destroying its permissiveness or normal interaction processes?
2. Can a workable distinction be made between the positive and negative styles of conference leadership?[1]
3. Can a conference leader be trained to alternately employ these two styles of leadership? If so, how?
4. Can a conference leader employing these two styles of leadership consistently achieve unanimous verbal agreement from a group regarding the solution of a controversial topic? If so, will the group exposed to one style feel truly different about its solutions than a group exposed to the other style?
5. Does the so-called democratic approach to conference leadership produce significantly different results than the conventional autocratic approach? If so, what are some of these results?
6. If significant differences are produced, what are some of the measuring instruments which will detect their presence?

It was beyond the scope of the study to attempt a thorough investigation of each of these questions, or to strive for accurate quantitative measurements. It was the objective of the study to provide tentative answers on the basis of qualitative, experimental indications.

DESIGN AND CONDUCT OF THE EXPERIMENT

A 2x2x2 factorial design with four equated student discussion groups was used. It provided the fullest exploitation of the conditions existing at the time the experiment was undertaken. The design represents three factors at two levels each:

Factor	Level 1	Level 2
Leadership style	Positive	Negative
Leader personality	Leader 1	Leader 2
Discussion topics	Problem 1	Problem 2

A cross-over technique was employed, in the absence of an opportunity to recruit more than four equated groups, to attempt to balance the effects of the main factors and to provide a greater response sampling. This procedure may be illustrated as follows:

Group W

Leader 2, Problem 1, Positive Style
Leader 1, Problem 2, Negative Style

Group X

Leader 2, Problem 1, Negative Style
Leader 1, Problem 2, Positive Style

Group Y

Leader 1, Problem 1, Positive Style
Leader 2, Problem 2, Negative Style

Group Z

Leader 1, Problem 1, Negative Style
Leader 2, Problem 2, Positive Style

Some inducement had to be afforded the discussion participants to realistically keep them in the field of discussion. Four groups of nine college students each were equated from a total of 117 students who were enrolled in the writer's classes. Their discussion participations were related to their final course grades.

Two discussion leaders of dissimilar age and background were trained to alternately assume the positive and negative styles of leadership.

Under the positive style of leadership:

1. The leader draws upon the group for ideas or an agenda for discussion. Thus "activity perspective" is afforded the group and procedure becomes a matter for group decision.
2. The leader attempts to foster a permissive atmosphere by limiting his verbal participation to less than one-third of the total verbal activity of the group.
3. The major portion of the leader's activity is devoted (a) to demonstrating an emotional recognition and understanding of ideas and comments from the group; and (b) to providing technical or objective information for the group and clarifying issues by explaining and summarizing significant group thought periodically.
4. The leader attempts to maintain a matter-of-fact attitude, giving praise or censure sparingly and objectively.

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5. The leader employs role-playing, role reversal, and risk description techniques when they seem appropriate.[2]

6. The leader encourages compromise, intelligent understanding, and willing acceptance of group solutions by each group member as substitutes for decision by vote.

7. The leader may attempt to relieve group tension in a crisis through the use of group self-evaluation.

In many respects the negative leadership style is antithetical to the positive style. Under the negative style of leadership:

1. The leader unilaterally prepares an agenda for the group; the group gains knowledge of the agenda only as each topic or issue is presented by the leader. Thus "activity perspective" is denied the group, and procedure is determined by the leader.

2. The leader uses diplomatic persuasion to sell his ideas to the group.[3] Owing to this objective the leader's verbal participation tends to comprise more than half of the total verbal activity of the group.

3. The leader acts as an expert information giver and tends to give greater emphasis to those data which support his views; he periodically clarifies and summarizes, but in a manner which is favorable to his position.

4. The leader demonstrates partiality by giving praise and encouragement to those factions or individuals who support his views, and polite criticism to those who do not.

5. The leader discourages the use of role-playing, role reversal, and risk description techniques; if he were to use them, it would be in a manipulative manner designed to substantiate his position.

6. The leader encourages acceptance of his position and disposes of individual or factional opposition by the employment of majority votes if possible.

7. The leader attempts to relieve group tension in a crisis through the imposition of his authority upon the group.

The positive leader was to continue the discussion of a problem until verbal unanimity regarding solutions to the problem was achieved, or until seemingly nothing more could be gained through continued discussion. The negative leader also was to continue a discussion until verbal unanimity or seemingly hopeless impasse was reached; however, he was to attempt to "sell" solutions to the group.

Student surveys were conducted to determine experimental discussion topics which would be controversial and of interest to the participants. The experimental discussion problems were:

Problem 1: "Should Negroes Be Admitted to White American Colleges? If So, Under What Conditions?"

Problem 2: "Should Anything Be Done About So-Called Professionalism or Commercialism in Inter-Collegiate Football and Basketball? If So, What?"

Various measuring devices were developed to provide indications of the effects of the positive and negative styles of leadership. A brief discussion of the nature, function, and administration of these instruments follows.

Observer Ratings.–Two observers were trained to independently classify all discussion utterances into one or more of three categories: objective task functions, positive social functions, and negative social functions. These ratings were made to provide an indication of group permissiveness and coöperativeness.

Attitude Dispersion Scales.–These scales were designed to measure the pre-discussion and post-discussion attitudes of the group members and to provide an indication of the degree and direction of any attitude change effected by the discussion. There were two scales, one for each experimental problem. The appropriate scale was administered before and after the discussion of a problem to each member of the discussion group. As was the case with all of the questionnaires, the identities of the respondents were never known to the writer or others; secret group numbers known only to the holders were used.

Post Meeting Questionnaire.–An eight item questionnaire was administered at the conclusion of each discussion meeting. This questionnaire was designed to provide indications of group permissiveness, participant satisfaction with solutions reached, the presence of attitude change, and the extent to which the group members were aware of the presence of the observers.

Post Problem Questionnaire.–A fifteen item questionnaire was administered approximately one week after the conclusion of each experimental discussion. This questionnaire was designed to provide indications of group permissiveness, participant satisfaction with solutions reached, the presence of attitude change, participant satisfaction with discussion leadership, friendship formation, the popularity of group members, intra-group competition, and communication.

Final Questionnaire.–A thirteen item questionnaire was administered approximately two weeks after the completion of the last experimental discussion to the members of all four experimental groups. This questionnaire was designed to provide indications of participant satisfaction with solutions reached, the presence of attitude change, and the degree of realism achieved in the experimental environment.

Leader Time Record.–The writer kept a record of the total verbal participation time of each leader for each discussion. This record was compiled to provide an indication of the degree of permissiveness resulting from the leader's encouragement of others to express themselves.

Experimental discussions were held for a maximum period of 2 hours and 24 minutes per meeting, excluding time devoted to giving instructions, "breaks," and the completion of forms by group members. Discussion participants were seated about a conference table with the discussion leader at one end. After certain preliminaries, the leader initiated and conducted discussion while the writer and the observers performed their respective duties nearby. The study required ten experimental discussion meetings.

RESULTS OF THE EXPERIMENT

Certain hypotheses relating to the questions posed were formulated. These hypotheses were tested by subjecting the experimental data to "t" tests and tests of Chi-square, the 5 per cent level of significance being the criterion for accepting or rejecting the assumption of interdependence between the factors considered. Analysis of the data provides support for the following hypotheses:

1. A realistic discussion situation may be created in an experimental environment if certain precautions are observed.

2. Experimental leaders can be trained to successfully differentiate, conceptually, between the positive and negative styles of leadership.

3. Leaders can be trained to successfully adhere to the written and conceptual style definitions as they alternately assume the positive and negative roles of leadership.

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4. Verbal unanimity may be achieved through the skilled application of both styles of leadership. Positively led group members will tend to accept as their own, and be satisfied with, group solutions to a much greater extent than will negatively led group members.

5. Positively led groups will require more time to achieve verbal unanimity or the completion of a discussion than will negatively led groups.

6. The positive style of leadership will create a friendlier and more permissive group atmosphere than will the negative style.

7. Positively led group members will be better satisfied with the performance of their leader than will negatively led group members.

Experimental data relating to the two following hypotheses are inconclusive.[4]

1. Positively led group members will tend to be less competitive and more coöperative than negatively led group members.

2. The positive style of leadership will tend to provide for more effective communication within the group than will the negative style.

CONCLUSIONS

Despite the fact that the positive style of leadership consistently required more time for the completion of a discussion, the results indicate that the positive style is superior to the negative style in many respects. The positive style will produce more per unit of time and, consequently, is more efficient than the negative style. Other results which may be expected from use of the positive rather than the negative style are:[5]

1. A more permissive and friendlier group atmosphere.

2. Greater group member satisfaction with the performance of the conference leader.

3. Greater group member satisfaction with, and acceptance of, group solutions; therefore, superior capacity for changing the attitudes of participants.

It is clear that genuine attitude change may be better effected by attempting to evolve decisions from a decision making conference group rather than by attempting to impose them upon it. Also, the usefulness of conference decisions will depend largely upon the extent to which they are successfully implemented. Successful implementation will occur if those responsible for it are adequately motivated, if, that is, they can achieve sufficient identification with, or faith in, the decisions they are to implement. Positively conducted decision making conferences seem to provide a means for assuring adequate implementation.

Persons of varying ages and backgrounds, when properly trained, should be capable of effectively assuming the positive style of leadership; for certain elements of this style seem to be independent of leader personality. Results indicate that the best prospect for altering a given person's leadership behavior will be afforded by teaching him to perceive and effectively assume the two styles of leadership and by giving him the opportunity to experience the impact of these styles upon practice groups. This type of conference leadership training should provide executives and supervisory personnel with an optimal type of human relations training. It will give them a more useful approach to grievances and human relations problems which arise in the work-place and provide them with a better understanding of those factors which contribute to group unity.

The attainment of true unanimity, or intelligent understanding and willing acceptance of group solutions, is a realistic and productive goal for the conference leader employing the positive style of leadership. However, the achievement of such unanimity should constitute an objective, not a condition which will have to be satisfied before a discussion can be terminated. Such true unanimity may be achieved even more frequently than was verbal unanimity in the course of this experiment. This should be attainable if the leaders concerned have the opportunity to develop a high level of skill in assuming the positive style of leadership and if they can provide their groups with a greater amount of pertinent, objective data than was available to the experimental leaders.

LIMITATIONS

The value of these conclusions depends upon the assumption that other conference groups will react to given stimuli in the same manner as the experimental groups. A representative sample of business executives was not utilized in the formulation of the experimental groups, yet the suggestion is made that these findings are appropriate for executive and other groups. This places a definite limitation upon the utility of the experimental data obtained. However, this limitation is weakened by the fact that these findings substantially agree with those of certain other experimenters who used experimental groups which were dissimilar to the ones used in this study. Consequently, a more valid basis is afforded for predicting that other groups may believe in a similar manner.

SUGGESTIONS FOR FUTURE RESEARCH AND DEVELOPMENT

A valuable contribution to knowledge about conference leadership can be made by attempts to isolate and assign relative values to the functional components of the leader's style.

Further investigation of the influence of age and experience upon the trainee's capacity for the type of leader training given in this study and the time required to accomplish it will prove helpful.

It seems desirable to investigate further the effects of meeting length upon group productivity.

Microfilm $2.85; Xerox $9.80. 217 pages.

1. For this experiment the terms "positive" and "negative" were respectively substituted for the terms "democratic" and "autocratic."

2. For further information about risk description, see Maier, N. R. F. "Improving Supervision through Training." Reprinted from Psychology of Labor Management Relations, Industrial Relations Research Association, 704 S. Sixth St., Champaign, Ill., p. 34.

3. In this study the negative leader adopted and attempted to "sell" as his own the decisions arrived at by the groups under positive leadership.

4. Though inadequate, the data obtained do favor these two hypotheses.

5. These observations, of course, do not apply to situations which require immediate action when use of the positive style is effectively precluded.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

Abstract published by special arrangement with The Ohio State University.

EXTERNAL TRADE, CAPITAL IMPORTS, AND ECONOMIC GROWTH: THE CASE OF PUERTO RICO

(L. C. Card No. Mic 59-2846)

Joseph Emerick Haring, Ph.D.
Columbia University, 1959

This study is an examination of the roles of external trade and capital imports in the recent economic growth of Puerto Rico. The central focus of the analysis is on the period after 1945, although it has been necessary to trace the evolution of the insular economy since 1898, when the island became a possession of the United States.

The principal theme of the study is that external trade has provided two powerful engines of growth for the historically poor economy of Puerto Rico. The first engine is the one Robertson recognized in the primary producing countries of the 19th Century, and is exemplified in Puerto Rico in the expansion that occurred between 1898 and 1928. This growth was based on the expanding market for sugar in the United States. The year 1925 marked the advent of a sugar glut in world markets, and by 1928 even Puerto Rico's duty-free entry into the U.S. market could not shield the island economy from stagnation. The export of Puerto Rico's primary product ceased to provide a basis for economic expansion substantially beyond the level reached in 1928.

From 1928 to 1941 Puerto Rico's economy grew very slowly. Quota restrictions on sugar exports to the U.S. were established in 1934, rendering the prospects for renewed growth on the basis of primary exports even dimmer. It was during this period, if ever, that diversified production for the home market may have been profitable, since the world markets for almost all products were stagnant. There may have been some balanced (i.e., diversified) growth during the 1930's, but most of the development that occurred was oriented around the relief and reconstruction expenditures of the Rooseveltian "New Deal."

It was only in 1941 that the second external trade engine of growth began to function. This growth, particularly as evidenced after the end of World War II, was oriented around the production of a diversified range of consumer manufactures for the mainland, though the home market was also supplied to a certain extent. The expansion of the American market after 1941 provided a major impetus to growth in Puerto Rico. Export manufactures have been a rapidly increasing proportion of national income since that date.

A second theme revolves around Puerto Rico's successful efforts to attract both portfolio and direct foreign investment from abroad. Considerable attention is given to these methods of inducing capital imports, and to the analysis of the flow of capital to the island. It appears that a correct understanding of investors' motivations has made it possible for Puerto Rico to expand her economy on the basis of external capital at a time when many poor countries were hard put to effect any capital imports at all.

The third major theme is that Puerto Rico's allocation of capital has been efficient and remarkably consistent with criteria suggested by Nurkse, Kahn, Lewis, and Schultz. Specifically, the heavy emphasis on social overhead capital seems to have greatly expanded the potential productivity of the economy, while the importation of technical skills has stimulated the use of the island's economic potential.

The relevance of Puerto Rico's experience to the growth problems of other poor areas of the world is outlined in some detail, with one chapter devoted to a careful comparison of Jamaica's recent experience in external trade, capital imports, and economic expansion with that of Puerto Rico. Other parallels are drawn to the published accounts of external aspects of growth in Hong Kong, India, Cuba, and several Latin American countries.

Microfilm $3.50; Xerox $12.00. 271 pages.

AN ANALYSIS OF THE DEVELOPMENT OF ADMINISTERED PRICES FOR AGRICULTURE: 1924-1929

(L. C. Card No. Mic 59-1784)

James Robert Hoath, Ph.D.
The University of Nebraska, 1959

Adviser: Edward Benjamin Schmidt

This study dealt with the process of economic policy formation during the 1920's with regard to farm relief. The apparent anomaly of a price policy that persisted in spite of adverse criticism and analysis was the motive for the investigation. The legislative courses of the McNary-Haugen bills and the Agricultural Marketing Act of 1929 were chosen as the immediate subject of study. The four McNary-Haugen bills from 1924 to 1928 proposed government sponsored storage and export of farm surpluses to enhance domestic farm prices. They presaged more recent agricultural price policy and provided a historical account of the policy-making process involved.

A prevailing concept of the policy-making process influenced the choice and use of materials employed in the investigation. The process is one of interest groups seeking to promote their ends through the various avenues of influence available to them.

The investigation related one object of group pressure - the role call vote in Congress - to economic, social and political interests. Each state and congressional district was studied with regard to major economic and political characteristics of the 1920's. Each Representative was identified according to political party, status and seniority, and economic characteristics of his district. Each Senator was identified only with the rural income and population ratios of his state, the chief item of farm production, and his political party. An analysis was made of the relations between these factors and roll call votes.

The pattern of economic and political interests discerned among the states and districts provided the basis for conjectures about the voting behavior of the Representatives and Senators. These hypotheses suggested in part a division of votes between rural and urban areas, and between areas producing products for export and products mainly for domestic markets. Districts and states with mixed economic and political interests would show less voting consistency than others. An analysis of 7 roll call

votes in the House and 15 in the Senate on the McNary-Haugen bills supported these hypotheses with some qualifications.

The analysis suggested that the economic circumstances of areas represented in Congress were stronger factors in the farm relief debate of the 1920's than was official party position. Factors of status and seniority, the political party, and the economic aspects of each district's individual farm enterprises were not visibly related to the Representative's vote. An exception was the course of the Agricultural Marketing Act of 1929, which was partisan, with Republicans supporting the measure and Democrats opposing it.

Future policy will increasingly reflect the interests of growing urban and industrial classes if political processes follow the course suggested by this study.

Microfilm $3.10; Xerox $10.60. 238 pages.

INVESTMENT DECISIONS AND THE ELECTRIC POWER INDUSTRY

(L. C. Card No. Mic 59-2666)

Jack Allyn McEnroe, Ph.D.
Syracuse University, 1959

At present there is a need to investigate decision-making in industry and to accumulate case studies on investment decisions. Examination of the businessman within his environmental setting can enable a more objective discrimination between various investment theories, help determine the extent to which generalizations about the businessman are possible, provide insight into actual happenings in the business sector, and help evaluate the future course of economic events.

This paper, Investment Decisions and the Electric Power Industry, is divided into two parts: the first, the discussion and development of a general framework with which to evaluate investment decisions; and the second, the application of the framework to the electric power industry with the aid of a case study.

This study suggests, in general, that the significance of the marginal efficiency of capital is overemphasized as a general determinant of investment in all industries. It is concluded that institutional patterns, sales stability, and the uncertainty attached to a sales estimate tend to temper the importance that the decision-maker attaches to the prospective volume of profit. Also, the significance of the marginal efficiency of capital as a determinant of investment varies from industry to industry depending upon the market structures and institutional patterns found among industries. The most important generalization suggested, however, is that the uncertainty of a profit expectation stems from the sales estimate, based upon an expectation of future income levels, and is carried to the profit calculation from this estimate.

More specifically for the electric power industry, it is concluded that the determination of the future volume of investment can be made earliest by analyzing the sales expectations of the firms in the industry. A review of the factors generally considered vital in the investment decision, along with the observations made in this study, indicate that cost and profit are variable rather than fixed factors in the decision; and that most adverse affects caused by uncertainty are minimized by prospective price adjustments or because the demand levels obtained are stable through time. Consequently, the expected volume of profit, the interest rate cost of the expansion, and other general costs of operation may be regarded largely as extraneous in the decision to invest. The short-run inelastic price demand schedule for electricity, the obligation to serve, the relative immunity of the sales level to income slippages, and the managerial desires for the continuity of the firm make the sales expectation the significant factor in the decision to invest in this industry.

Microfilm $3.25; Xerox $11.00. 250 pages.

THE IMPACT OF A FLOOD CONTROL PROJECT UPON THE ECONOMIC AND SOCIAL STRUCTURE OF THE AREA

(L. C. Card No. Mic 59-2627)

Henry John Meenen, Ph.D.
University of Missouri, 1959

Supervisor: O. R. Johnson

This was a study to determine if the effects of the implementation of a policy, such as a detention reservoir and levees to control floods, to attain a specific goal, the maximization of social product over time, was consistent with the goal itself. The findings indicate that some inconsistencies did exist. The project studied was the Wappapello Reservoir on the St. Francis river in Wayne county, Missouri and levees to St. Francis Arkansas.

The people in the reservoir area and the area between Wappapello and St. Francis, Arkansas did not receive adequate information about the project and how it would affect them. Delays in notices of acceptance of options and of payment of from three to five years made planning and repurchase difficult. Owners who accepted the options as offered received an average of 93 percent of the appraised value. Owners who carried their case through condemnation procedures received 144 percent of the appraised value.

The relocation of people and restoration of their economic and social institutions involved costs other than the land and immovable capital. Local people were not compensated for moving expenses, cost of relocation and other disturbance costs.

Management of the public land within the reservoir area was found to be inadequate. Land had not been classified as to potential use. The method of awarding leases and lease terms were not conducive to sound, land management practices.

The relocation of the urban sector was facilitated by the organization of the Greenville Improvement Corporation.

The removal of privately owned lands from the tax rolls resulted in a reduction in county and school funds. In order to make up for this, the Federal government turned back 25 percent of the rental income they received prior to 1946 and 75 percent after that date. In the early years of the project, county funds for roads were short.

The reservoir made necessary a major reorganization of school districts and the road system. Adequate plans had not been worked out prior to their need. An equitable

plan for the distribution of total funds available for their support had not been developed. Although funds for both were short in the early years, schools were able to draw sums from the State Equalization Fund.

Considerable use was being made of the Wappapello Reservoir for recreational purposes. A master plan had not been prepared, however, until 1946. Inadequate roads, and utilities were the main deterrents to more adequate development.

The final approved plan for flood control included the use of levees below the Wappapello Dam to St. Francis, Arkansas. Initially the land, easements, and rights-of-way were to be furnished free of cost to the United States government. In 1946 the statutes were modified to allow the United States government to take title to the land. By the time of this study little progress had been made. Local organizations had to raise funds to buy the land, easements, and rights-of-way by means of taxes. Drainage districts could only levy taxes according to assessments based upon benefits derived from drainage. The tax burden between and within districts would not have been in accordance with benefits received from flood control.

One down stream problem did not appear to have received adequate study prior to the approval of the project. This was the flood hazard caused by accumulated surface water which had no outlet as long as the discharge from the detention dam kept the river at bank full stage.

Microfilm $2.50; Xerox $8.80. 191 pages.

AN INVESTIGATION AND EVALUATION OF WORK MEASUREMENT AS AN ADMINISTRATIVE CONTROL (WITH EMPHASIS UPON THE MILITARY SITUATION)

(L. C. Card No. Mic 59-2565)

Richard Thompson Rudduck, Ph.D.
The Ohio State University, 1954

Introduction to Work Measurement

Private industry, beginning with Taylor's shoveling experiments, has made great strides through the use of motion and time study methods in the work measurement of direct labor applied to products by primary operative workers. With the advent of the gigantic organization (as typified by large Federal agencies) there arises the need for the measurement of administrative effectiveness as well as operative effectiveness. Simple statistical work measurement is a tool for such a purpose.

Operative measurement is concerned with measurement of projects or operative work. Administrative work measurement is concerned with group progress in executing programs. The latter is an expression of total group accomplishment. While both operative and administrative work measurement are important to control the activities of an enterprise, the study is concerned primarily with administrative work measurement for staff organizations.

Standards of performance involve two major methods or work measurement--(1) the traditional motion and time study methods and (2) The simple statistical analysis of past performance data on a group basis. The former is applied chiefly to primary operative work. The investigational methods are observational and standards set are absolute. The investigational methods of administrative work measurement are statistical and performance standards are relative.

The Present State of Development

The status of the developments in office work measurement was the subject of a panel discussion at the Office Management Conference of the American Management Association in New York City, October 16-17, 1952. The work being measured is almost entirely in the category of highly repetitive clerical, staff work, such as typing, filing, routing, and operating various types of business machines. Office work measurement was described as being in its "infancy."

The systems discussed at the American Management Association meeting have one or more of the following purposes:

1. The evaluation of monthly performance
2. The analysis of trends
3. Budgetary control
4. Determination of manpower requirements
5. Establishment of standard costs
6. Wage incentives to increase productivity[1]

Work measurement, as a result of a specific recommendation of the Hoover Commission Report, is an important part of the Federal Government's Management Improvement Program. Both motion and time study methods and the statistical progress has been in the measurement of primary operative work and in the area of highly repetitive clerical, staff work. Little has been accomplished in the area of administrative work measurement, although the Armed Forces are pioneering in this field.

Textbooks and handbooks on office management have made a contribution to work measurement by indicating the need and discussing elementary methods of work measurement. Little has been written on work measurement as an administrative control.

Scope, Methods, and Limitations of the Study

The primary objective of the dissertation is to discuss the value of simple statistical work measurement as a facilitative tool of administrative control in the management of a large enterprise. The scope of the study includes the following:

1. Development of a "method of approach" for the installation of a work measurement system
2. Analysis of the effectiveness of such a system as a tool of control
3. Evaluation of proper application of the system to increase the effectivity of an organization

The primary research consisted of a one-year project studying management problems and developing a system of work measurement applicable to the management of a large Naval shore station. The research was conducted at U.S. Naval Training Centers at Great Lakes, Illinois; Bainbridge, Maryland; and San Diego, California. The techniques developed and found successful in the installation of a system include (1) use of the "Local Command Work Measurement Manual," (2) use of the small group meeting, and (3) the method of professional staff assistance in aiding local personnel to decide on their own standards and other details of their systems.

The effectiveness of the materials developed and the

systems established was evaluated on the basis of reactions and suggestions of Naval personnel in the field; by evaluations of researchers working on the project; and by the pragmatic test of results, in the form of actual management improvements.

Any system of administrative work measurement is faced with the following inherent limitations:

1. Work measurement measures quantity relative to time, but not the quality of work.
2. It is a weak control of expenses, measuring only indirect expense of personnel wages and salaries.
3. It does not aid in deciding if work is in accordance with objectives.
4. It can result in improved manpower utilization at undue costs in quality, time, and other expense.

Conclusions

It is concluded that there is a pattern of limiting factors and forces inherent in the large, present-day organization. One of the foremost has to do with a clear understanding of the basic concepts of management.

1. Work measurement is only a facilitative tool and is useful only when corrective action is taken as a part of a management improvement program. It is concerned primarily with the performance of the control functions of comparison and corrective action. As such, work measurement data leads to organizational analysis, method and process analysis, and various other types of work simplification.

2. A clear understanding of administrative work measurement depends upon (a) an understanding of the organization's structure; (b) the relation between staff organization and basic management functions; and (c) the basic control function and the principles governing its performance.

3. Administrative work measurement acts as a quantity measure in establishing executive accountability for manpower utilization. The primary uses of the system are:

(a) It leads to management improvements, brought about by the application of work simplification techniques.

(b) It leads to cost reduction studies that can be used to support requests for facilities and personnel.

(c) It can be used to control staff operations. Comparisons can be made with past performance, with similar activities, and with established standards.

(d) It can be used to improve communications.

(e) It can afford a check on corrective action taken.

4. Installation of the system reveals a number of basic difficulties encountered in the development of a system. The factors listed are universal and have an important influence and effect upon the successful installation of a system:

(a) Correct attitude is important. This problem is chiefly one of communications. The need and uses of the system must be thoroughly explained before proper use can be expected.

(b) Adequate work units must be established. Not all work needs to be measured, but work units must be representative of the primary functions.

(c) Collecting work measurement data is a universal problem. If not solved successfully, the cost of collecting data may outweigh the benefits from the system. The systems used during the pilot studies included the use of clerks at control desks to record time spend on subfunctions. Establishing standard performance rates by application of the concept of "float time" would simplify the process and do away with recording time spent on subfunctions. Such a system involves proportioning clock time on the basis of "float time" or time-in-process for the different work units being measured.

Recommendations

From the investigation, analysis, and evaluation of the findings of the study, recommendations are outlined as a plan of action for industrial organizations and governmental agencies which find they face the administrative control problems inherent in the typical, large organization. There are three primary recommendations: (1) establishment of a course to train executives in the basic principles and practices of management; (2) the use of the coördinative staff or staff specialist to perform the staff functions of control; and (3) establishment of a permanent program of management improvement with administrative work measurement as one of the primary tools of control.

Microfilm $6.15; Xerox $21.40. 483 pages.

1. "Development in Office Work Measurement," Raising the Sights of Office Management. Office Mgt. Series No. 132. New York: American Management Association, 1952, pp. 19-38.

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EVALUATION OF ALTERNATIVE INCOME OPPORTUNITIES FOR FARM OPERATORS IN MACON COUNTY, NORTH CAROLINA

(L. C. Card No. Mic 59-2519)

Har Swarup Singh, Ph.D.
North Carolina State College, 1959

Supervisor: Lee R. Martin

North Carolina farm families receive relatively low incomes compared with farm families in many other states. Macon County is one of the poorer counties in North Carolina, and on a majority of farms the incomes are too low to provide a level of living comparable to that enjoyed by families elsewhere in the United States.

In the face of chronic low income farming, these questions arise: Do North Carolina farms have sufficient resources to obtain the desired level of income? Are the resources being employed to the best advantage? How can these resources be utilized best to maximize incomes?

The major objective of this study was to determine for typical farms in Macon County the kind of adjustments in resources and in resource use that would maximize farm income. Following this, an examination was made of the problems likely to be encountered in making the

recommended enterprise changes with a view to suggesting ways and means of overcoming the principal obstacles to change.

This study provides definite indications of the quantity of resources, quality of resources, enterprise combinations, and the farm and nonfarm relationships for more efficient resource use, given the objective of maximizing net farm incomes. The analysis provides the exact nature, magnitude and interrelationships of resource restrictions, external diseconomies and other conditions confronting different classes of farmers; with these data improved measures to cope with these limitations can be examined.

Attention may be drawn to two important features of this study: a consideration of the differences in the level of management of the various farm operators and adjustments in the linear programming technique that provided for additional flexibility.

The important recommendations may be recapitulated:

(1) Resource flexibility or changes in the quantity of available resources controlled by an operator is a necessary adjustment in a low income farming area.

(2) The productivity of increased quantities of capital under numerous resource situations has been thoroughly evaluated. Profitability of capital, if completely presented to farmers and lending agencies, may overcome their hesitancy to borrow or lend on the basis of expected productivity.

(3) Efforts should be made to expand existing market facilities and to seek new outlets for the enterprises being followed at present or are recommended to be initiated in the county.

(4) An intensive educational program to raise the quality of the human element is essential. Increases in the quality of the management inputs will yield greater increases in net revenue than any other single resource adjustment.

(5) Information about nonfarm jobs should be made available to farm families.

(6) Since optimum farm organization would change with changes in production technology, product and factor price, and consumer preferences, periodic study of the alternative possibilities should be made. Research and extension personnel and other educational agencies should evaluate adjustment possibilities, interpret and present these data to farm operators in order to encourage them to make profitable adjustments to changing conditions.

Microfilm $3.15; Xerox $10.80. 243 pages.

THE MEASUREMENT OF DEMAND FOR HOGS AND CATTLE AT THE FARM LEVEL

(L. C. Card No. Mic 59-2727)

Howard Copeland Williams, Ph.D.
The Ohio State University, 1953

An operational knowledge of the demand functions for specific agricultural products is fundamental for an understanding of basic market relationships. Moreover, it is basic to the formulation of effective farm policy and the provision of concrete data, with practical applications, to guide producers in making adjustments in their production and marketing programs so that they may increase the flexibility in their performance of the entrepreneurial function. This information is fundamental from the consumer point of view in that it facilitates the primary motive of economic activity, which is the maximum satisfaction with the minimum effort.

Theoretical demand analysis falls short in the provision of these data. It falls short because the assumptions upon which it rests do not approximate those of the market. For example, hypothetical demand analysis, in an attempt to reduce the analysis to one dependent and one independent variable (price and quantity), sets aside those variables which are the determinants of the level of demand. The latter variables, referred to as given, are assumed to remain unchanged in a given time unit. They include (1) incomes, (2) consumer preference patterns, (3) prices of other commodities, (4) expectations about future prices, and (5) number of buyers. Over a period of time, these conditions are not met in the economy in an operational sense. For the hypothetical approach is static and the market is dynamic. Hence pure theory, which uses the hypothetical approach, provides at best only a point of departure, a bench mark, or a model, and must be supplemented with an approach that allows time to exert its influence without limitations. This is accomplished through an empirical approach which attempts to derive the dynamic demand function determined in the market with the free play of all pertinent forces which affect its operation. It should be pointed out that over the past forty years there has been a continual extension of demand analysis to include more of those "endogenous" and "exogenous" variables which influence or disturb the functional demand relationship.

The approach used in this analysis was designed to approximate the dynamic demand function as it is determined in the impersonal market, functioning under conditions which are dynamic in nature.

The objective of this analysis, in a general sense, was the derivation of dynamic demand functions which would augment the acquisition of knowledge and thereby enhance the understanding of basic market relationships.

More specifically, the objectives of this analysis were to approximate the functional demand relationship, measure demand responsitivity, or elasticity, for changing price-quantity relationships, determine the demand interrelationships between hogs and cattle, and provide data that would lead to the establishment of one of the requisite criteria for the statement of predictions that are relatively certain.

In demand analysis it is possible to derive the demand function at the farm level, the wholesale level, or the retail, or consumer level for the same agricultural commodity. This analysis was designed to approximate the demand function and measure elasticity as it affects farmers as producers. Hence emphasis and attention were given to the demand function at the farm level.

This analysis used the classic single equation, least squares approach supplemented by deflation and regression analysis to derive and describe the demand functions at the farm level for these two agricultural commodities.

Those exogenous factors assumed a priori to influence or disturb the functional demand relationship were incorporated into the model. These factors included changes in population, changes in price levels, changes in the relationship between agricultural commodities, changes in productivity of workers in industry, and changes in real disposable income. An attempt was made through a process

of deflation to incorporate these factors in the manner in which they exert their true influence. These variables were used in differing combinations, with three different combinations being set forth. The first combination included per capita supply and weighted average market price adjusted by the Index of Prices Received by Farmers for Food. The second combination included per capita supply and the weighted average price adjusted by (1) the Index of Prices Received by Farmers for Food and (2) the Index of Output per Manhour in Industry. The third combination included per capital supply and the weighted average price adjusted by (1) the Index of Prices Received by Farmers for Food and (2) the Index of Real Per Capita Personal Disposable Income. By means of these combinations three demand functions, or attempted improvements, were derived. After each demand function was derived a "model index" was constructed. The purpose of this index was to get an approximation of a series of data which would reduce the vertical deviation about the line of regression to zero. This "model index" would result in perfect prediction within the limits of the data. This index was computed by dividing the observed prices by the computed prices.

The combination of factors which yielded the best fit of the regression line to the data, as determined by the descriptive constants describing each attempted improvement, was assumed to most closely approximate the demand function.

For both hogs and cattle the third demand function or attempted improvement gave the best fit of the regression line to the price-quantity data. A comparison of the descriptive constants for each of the demand functions is shown for hogs in Table 1 and for cattle in Table 2.

Table 1
Descriptive Constants of the Per Capita Demand Functions for Hogs, United States, 1929-1951

Measure	Demand Function One	Demand Function Two	Demand Function Three
Mean of Observed Price	$7.50	$7.18	$6.25
Average Deviation of Actual from Computed Price	$0.94	$0.78	$0.63
Maximum Deviation of Actual from Computed Price	$2.40	$1.77	$1.33
Minimum Deviation of Actual from Computed Price	$0.03	$0.12	$0.01
Standard Error of Estimate	$1.21	$0.91	$0.75
Coefficient of Determination	0.097	0.32	0.65

Once this demand function was determined it became the basis for the determination of coefficients of elasticity and net effect on producers as shown by changes in per capita outlay (revenue) for changing price-quantity relationships.

The analysis exhausted, fairly completely, the possibilities of adjusting by individual economic factors. However, there might be groups of economic factors which would result in considerable improvement once they were discovered and properly weighted into an index which could be used for adjustment purposes. Furthermore, there are casual relationships which significantly disturb the functional demand relationship.

Table 2
Descriptive Constants of the Per Capita Demand Functions for Cattle, United States, 1929-1951

Measure	Demand Function One	Demand Function Two	Demand Function Three
Mean of Observed Price	$7.18	$6.84	$6.12
Average Deviation of Actual from Computed Price	$0.94	$0.60	$0.54
Maximum Deviation of Actual from Computed Price	$3.33	$1.50	$1.12
Minimum Deviation of Actual from Computes Price	$0.04	$0.05	$0.00
Standard Error of Estimate	$1.26	$0.75	$0.63
Coefficient of Determination	.14	.17	.70

On the basis of the analysis and within the limits of the data the following conclusions were drawn:

1. Of the factors used, the demand functions for hogs and cattle were more closely associated with the prices of foods included in the market basket and real disposable income.
2. The fit of the regression line to the price-quantity relationships for cattle was better than the fit for the price-quantity relationships for hogs. Hence the price-quantity relationships for cattle were more closely associated with real, per capita personal disposable income than the price-quantity relationships for hogs.
3. The demand function derived from the variables of per capita supply and weighted average price adjusted by (1) the Index of Prices Received by Farmers for Food and (2) the Index of Real Per Capita Personal Disposable Income more closely approximates the one assumed by economists to exist when using hypothetical data.
4. The demand for hogs was inelastic up to 140 pounds per capita and changed from inelastic to unitary to elastic somewhere between a per capita supply of 140 and 160 pounds. The data indicated, without mathematical treatment, that the demand was unitary at approximately 145 pounds per capita.
5. The demand for cattle was elastic up to 100 pounds per capita and changed from elastic to unitary to inelastic somewhere between 100 and 120 pounds per capita.
6. Hogs and cattle possess the attribute of substitutability for each other.

Microfilm $2.00; Xerox $6.00. 133 pages.

Abstract published by special arrangement with The Ohio State University.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

ECONOMICS, COMMERCE – BUSINESS

A CRITICAL ANALYSIS OF THE EFFECT OF STATE AID TO INDUSTRY IN SELECTED AREAS

(L. C. Card No. Mic 59-2658)

Thomas Patrick Bergin, D.S.S.
Syracuse University, 1959

Industry, today, has joined forces with many sectors of the community, and is making a valuable contribution to the community's economic growth. It will inevitably, add to that contribution in the future. In the past, industrial-development programs ordinarily represented an activity limited primarily to the industrial areas of the larger communities. This is no longer true. The desire for new industry, and the prosperity it promises, is now manifested in literally thousands of local development-programs throughout the nation.

This study was undertaken to describe and evaluate the effectiveness of some of the state and local community programs designed to attract industry and to encourage development. The programs were classified as to one of two types:

1) State Aid--based primarily upon tax exemption and public credit.
2) Private Assistance--based primarily upon private sources of income and cooperation.

While there is some overlapping of the two programs, state aid is found primarily in those areas which are under-developed industrially. The states selected as representative of this type of development program were Mississippi, Tennessee and Kentucky. Private assistance is most prevalent in the more mature industrial areas which are determined to maintain and expand their industrial capacity. The New England States and the State of New York, with their development credit corporations, were selected as representative of this type of program.

The source material for this study was secured through an examination of the published material in the field; through personal interviews conducted in New England, New York, Mississippi, Tennessee and Kentucky with the various state representatives responsible for the operation of their development programs; and from data gathered in a two page questionnaire which was answered by 272 representative industries recently located, or expanded, within Mississippi, Tennessee and Kentucky. The questionnaire represents a 33.2 per cent return.

The study provided some evidence which would indicate:

1) that the private assistance programs such as the development credit corporations, although representing very modest sources of capital, have been reasonably successful to date, but may ultimately have to face some serious problems, namely:
   a) securing additional stock subscription in order to provide sufficient funds for lending,
   b) accomodating a greater number of smaller firms and thus reducing the rejection rate - or face, perhaps, real competition from the Federal Government,
   c) sustaining the support of local citizens and the willingness of institutional members to continue to accept the present interest rates,
   d) Surviving through periods of serious losses and/or recession.
2) that, by and large, the traditional factors of the availability of markets, labor and raw materials are as important today as ever in influencing industrial location,
3) that temporary tax relief has little or no influence upon the final decision if management is looking for a permanent location,
4) that, these special state aids have created some new problems of competition among the various states and communities as they bid for new industrial facilities,
5) that in the final analysis, industry will locate in those areas wherein management foresees opportunities for substantial profit,
6) that these organizations tend to over-emphasize the effectiveness of certain aspects of their respective programs,
7) that in some instances, the states might well re-appraise and re-evaluate their approach to industrial development in order to determine whether or not they are receiving maximum returns for the money and time expended.

Microfilm $2.50; Xerox $8.80. 191 pages.

A STUDY OF AUTOMATION IN A SELECTED COMPANY

(L. C. Card No. Mic 59-2730)

Luther Doyle Bishop, Ph.D.
The Ohio State University, 1959

This study was undertaken in an effort to obtain a clearer picture of the problems raised by automation in an individual company. The Ohio Bell Telephone Company was selected as the subject because of its many years of experience with automation in the form of step-by-step central office equipment and, in later years, with crossbar and automatic message accounting equipment. Detailed studies were made of two local office conversions and of the installation of an automated accounting center. Research methods included analysis of company records, interviews with company employees, a mail survey, and direct observation.

The use of cutover planning committees composed mainly of local management personnel secured the benefits of a proper application of the participation principle of management. Effective and public orientation concerning the conversions was accomplished by bulletin board announcements, conferences with small groups of employees, newspaper articles, and talks to civic groups by management employees. Training of employees in the keeper group for post-conversion jobs was successfully accomplished by a combination of lecture-discussion sessions and by practice on photographic mock-ups of the new equipment. Careful scheduling of the training program made it possible to carry on the regular work and to complete the training just prior to conversion.

A study of the bargaining of individual cutover agreements

revealed no major disagreements between the two parties over automation. Extensive efforts were made to transfer surplus regular employees to other local offices. Termination payments to regular employees who had to be laid off served the purposes of cushioning the shock of unemployment of encouraging resignations at the proper time. The re-employment programs following conversions resulted in the return of approximately one-half of the laid-off employees to their jobs with the company. Approximately one-half of those who returned resigned within a relatively short time. A large percentage of the transferred employees either transferred back to the original location or left the company.

The main problems caused by automation in the plant department were the development of new maintenance skills and the multiple transfers or promotions caused by force expansion. Employment in the plant department increased by about 30 per cent as a result of automation. Other departments were not substantially affected by central office automation.

The establishment of the automatic message accounting center in Cleveland, Ohio, which resulted in the transfer of some accounting work from local accounting and traffic forces to the central office did not cause any technological unemployment. The main problems encountered included the difficulty of balancing the center's capacity with requirements and the lack of a standardized accounting procedure which would permit more extensive use of this type of automation.

Analysis of overall statistical data revealed that total employment in the company has increased rather steadily since 1922. Employment in individual departments has increased also; however, the increase in the traffic department has not been in proportion to the increase in volume of work. Analysis of costs for various functions indicated an increase for the plant, commercial, and accounting functions; a decrease in the relative cost for traffic and depreciation and amortization; and practically no change in other major expenses. Artificial regulation of telephone rates obscured the effect of automation on the company's profits.

Microfilm $4.55; Xerox $15.20. 355 pages.

PRIORITY DETERMINATION IN MILITARY RESEARCH AND DEVELOPMENT

(L. C. Card No. Mic 59-2811)

Stewart Penfold Blake, Ph.D.
Stanford University, 1959

The cost, complexity, and importance of weapon systems is increasing constantly. For this reason expenditures in the United States for research and development in military areas are growing at an accelerated rate. Due partly to increased research and development expenditures and partly to natural acceleration stemming from new knowledge, military equipment is becoming obsolete at an alarming rate.

The managers of military research and development are faced with a multiplicity of proposals and with many promising, but costly, areas for investigation. At the same time they are bound by limitations on funds, manpower, and materiel. They must therefore make every effort to ensure that the highest priorities are assigned to those projects which are vital to the national defense.

The Department of Defense desires to support a research and development program which will maintain a margin of technological superiority over our potential enemies. It must ensure also that no more resources be expended than can be used effectively. The problem that confronts the managers of military research and development is how best to analyze and evaluate projects, both proposed and in progress, and to assign to them indicators of relative priority.

An examination was made of the history of the management of research and development in the Defense Establishment. Particular attention was given to the research and development organizational structure and to recent legislative proposals in this area.

Certain universal factors were considered in the process of priority allocation. Among these were: the adequacy of current equipment; the research approach to be followed; the effects of time and the advancing state of technology; the importance of comparable costing methods; the limitations imposed by shortages of both manpower and material, and the effect of the manifestations of social dynamics on priority determination.

Beyond the evaluation of projects on these bases lie the considerations imposed by the implementation of national policies. This can be summarized as the inter-relationship of national objectives, strategy, and weapon technology.

The systems for priority determination and allocation used in the military services were analyzed critically. It was determined that they are defective in major respects and must be revised.

This study is primarily concerned with the fundamental concepts and factors which must underlie research priority determination. Major consideration was given to the methodology of project analysis and evaluation rather than to the design and construction of a detailed priority system.

The study resulted in a clear delineation of the fundamentals which must be known and understood by those concerned with the management of military research and development. It is the opinion of the author that the major areas wherein improvement is needed are: the provision of detailed and consistent policy guidance to the Department of Defense; the centralization of military research and development policy control within the Department of Defense with the concurrent decentralization of operating authority to the military departments; the reduction of decision time within the Department of Defense; and the implementation of a common philosophy of research priority determination throughout the Department of Defense. It was further concluded that these improvements can be made largely within the present organizational framework.

Microfilm $3.05; Xerox $10.60. 236 pages.

CHANNELS OF PERSONNEL COMMUNICATION WITHIN THE MANAGEMENT GROUP

(L. C. Card No. Mic 59-2308)

Keith Davis, Ph.D.
The Ohio State University, 1952

In any organization communication among its members is fundamental to its proper functioning, because, as one author explains, "It is obvious that without communication

there can be no organization, for there is no possibility then of the group influencing the behavior of the individual."[1] Many management specialists believe that communication is one of the foremost business problems. Roethlisberger considers it one of the three human problems of management,[2] and Peters regards the solution of communication problems as the "first objective in personnel administration."[3] One reason for a current special emphasis on communication is that very little communication research has been done.

This project seeks to fill the gap in research knowledge by examining channels of communication within the management group in business. It was shown that a channel is, in theory, a major communication variable. Analysis was focused on the channel dimensions of organizational function and organizational level or scale, in relation to communication content and media. Communication was defined as the transmission of symbols from one person (initiator) to another (recipient). Personnel communication was defined as such communication to a member of a formal organization as involves primarily that organization or any member's relation to that organization. If a communication was from a member to a member, it was organizational. If it was from a non-member or a member in a non-member role, it was extra-organizational. Channel was defined as the route which a communication follows from person to person, in terms of some dimension. Communication media or methods were divided into three classifications: aural (sound), visual (sight), and all other. Each media was further subdivided into techniques, such as a company magazine and a company handbook.

The overall objectives of this project were to develop a framework for analysis of channels and related problems, to develop a method which would secure the desired analytical information, and to try both the framework and method in a trial run in a company. The thesis was that there are variables in channels and that development of a means of analyzing them would provide management with information to improve its understanding and control of such variables. It was hoped that results of the project would give insight to such problems as the following:

1. Over-all questions of the dynamics of communication flow within management.
2. The relation of content and media to channels.
3. The relation of communication channels to lines of authority.
4. Proportions of communications received by different levels and functional areas, or initiated by them.

The main analytical framework consisted of selected functional and scalar classifications of organizational communication channels. With regard to scale, communication was classified as interscalar (between organizational levels) or intrascalar. Interscalar communication was subdivided according to direction (up or down) and intensity (number of levels traveled in a single transmission). With regard to function, three major classifications were established. In terms of functional role, there were the management group and the operative group. There were also a line group and a staff group, which related function to its organizational objective. In terms of the functional activity with which a person worked, five groups were established: production, sales, finance and office, personnel, and general management. Communications between activities were interfunctional, and those within an activity were intrafunctional.

With regard to method, certain characteristics of survey research method were established to be generally desirable, including anonymity, adequate selectivity, low cost, minimum interference with respondent's normal routine, simplicity, adequate proportion of responses, adaptability, production of results quick enough for usefulness, and ability to be used with minimum effect upon the situation studied. An adaptation of the questionnaire survey method was selected for use in this project. In order to secure detailed, specific, situationally-oriented, and timely information, the survey was focused on the episodic communication, which was defined as a communication about an episode. An example is, "Joe Jones was promoted to Superintendent yesterday."

The field study and trial run was made at Tex Tan of Yoakum, a tanner and manufacturer of leather, which had 67 management employees at five organizational levels. Fourteen surveys, each about a different episodic communication, were made during a period of three months in the summer of 1951. For each survey, responses were secured from the entire management group, excluding random absences. Each person responded in terms of his role as a recipient, rather than an initiator, and he gave information about only his first receipt of the information.

In order to maintain anonymity respondents were placed in 17 groups on the basis of functional and scalar similarities. Groups were designated by a four-digit code number which is explained in Figure I. The respondent was identified only by this code number, and if he was a recipient, he identified his initiator with the initiator's code which he secured from an alphabetical list of executives and their codes. In this manner, channels between organizational groups were recorded. For the last three surveys, a fifth and sixth code digit were used, which identified each individual initiator and recipient to the surveyor only. In this manner, channels between organizational individuals were recorded. Code numbers were also used for communication subject, communication media, and time of communication.

Respondents were instructed about the project in a 30-minute meeting and by two preliminary surveys. Questionnaires were distributed within a range of 15 hours to three months after an episode's origin. Each survey was distributed and collected within a four-hour period, except for the few surveys which were distributed or collected by mail in order to test the mail method. Use of the mails proved feasible. A summary of the standard survey procedure is presented in the next paragraph.

The selected episode question and necessary time relationships were typed into a prepared stencil on the morning of the survey, and copies were made. The surveyor coded the exact number of questionnaires for each group. The questionnaires, arranged in code-number order, were personally distributed by the surveyor. As a questionnaire was given to a respondent, his name was checked off. All questionnaires not distributed were accounted for by absence of the respondent. As soon as all questionnaires were distributed, the surveyor began to collect them. Respondents dropped their "ballots" into a leather shoulder bag carried by the surveyor. The survey was completed when the surveyor collected all questionnaires.

In the trial run there were 807 replies, 337 from recipients and 470 from non-recipients. The recipients' replies were analyzed in detail, coded, and mechanically tabulated. Each individual survey was tabulated and

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analyzed, as well as the over-all data from all surveys. The data tabulated were survey number, initiator's identification, recipient's identification, communication subject, media, time elapsed since receipt, organizational nature of channel, scalar channel, line-staff channel, and functional channel.

In general, most of the expectations of the project were accomplished. The most significant result was the clear evidence that management, by using the established framework and method, can get detailed information about communication channels and other variables. It is believed that management can use this technique now, employing the same skills and equipment with which it makes attitude surveys. This technique tends to do for the communication problem what the attitude survey does for the attitude problem; that is, to provide information for scientific analysis and management of the problem. The framework and method will apply to many types of organizations and situations, and can be used to secure and analyze information about many communication variables or dimensions. The overall technique is flexible, economical, factual, quantitative, and applicable with minimum interference to operations. Its use on a large scale should lead to the formulation of many general principles about communication and to consideration of the best way, or ways, to communicate in a given situation.

A second significant result of the project was that individual channel analysis provided, for the first time as far as is known, an established way to record complete "grapevine" patterns. Since communication is the bloodstream of informal organization, "grapevine" analysis affords management new opportunities to study the informal organization.

A major limitation of this technique is that it is mostly confined to analysis of communication which is clearly episodic. Furthermore, it provides no direct information about how attitudes and abstractions, such as belief in free enterprise, and transmitted, because these abstractions are complicated communication effects caused by interactions of many stimuli on individuals. The technique does, however, provide some concrete indirect information about these things.

Some of the results of the trial run are described in the following paragraphs. With regard to organizational level, the study showed that episodic information was nearly always known at all levels, but only among about two thirds of the functional groups. Each higher organizational level tended to have a greater proportion of recipients than those below. The higher levels tended to initiate even more than they received. As a result the predominant flow was interscalar and downward. The top and bottom levels were mostly isolated from each other; so most communications travelled only one or two levels at each transmission.

Both upward and downward communication was blocked between levels 4 and 5 by a group of line superintendents. Upward communications were trivial. More than half of them were from operatives, entered the production function at lower levels, and concerned management personalities. All upward communication was aural.

Initiation was always less widespread than receipt, regardless of whether the unit of classification was levels, surveys, persons, or functional groups. Functional groups varied widely in their porportions of initiations and receipts. Initiations at level 6 did not travel outside each initiator's functional group, but at other levels over four-fifths of initiations were transmitted between any two of the 17 functional groups. Even when groups were classified into five broad activities (production, sales, finance, personnel, and general management) 62 per cent of communications were interfunctional. This tendency existed for both interscalar and intrascalar communication, which indicates that management should devote more attention to skills and methods of cross-communication.

The staff both initiated and received somewhat more than the line. Both line and staff used mostly aural media. The line-staff subject classification of each survey always coincided with the initiation element of the predominant line-staff channel, which indicated that both line groups and staff groups initiated more when the subject related to them and regardless of whether initiation was formal or informal.

The trial run led to the establishment of five formulas to describe significant communication relationships. These formulas are stated in Figure II. Their use allows quantitative expression of certain relationships and makes comparisons between organizations more feasible.

Some of the ways in which business can use the techniques of this project are as follows:

1. To make a focused study of a communication problem area, for the purpose of determining the problem's causes and possible remedies.
2. To make interdepartmental or interplant comparisons in relation to other variables such as morale, in order to determine the nature of relation between communication and the variable.
3. To develop principles and patterns for the best ways to communicate in given situations.
4. To make both periodic and continuous audits of communications in a company, in order to determine the extent to which various types of communication are reaching particular functional and scalar areas.
5. To aid in executive training about communications. Single surveys provide excellent case studies.
6. To aid in study of the informal organization and the "grapevine," so that management may learn how to use and control the "grapevine" to the extent possible.

On the basis of the evidence presented in this study, it is concluded that analysis of episodic communication channels in organization can be useful to business. Its limitations restrict its use, rather than prohibit that use.

FIGURE I

KEY TO CODE NUMBERS FOR IDENTIFICATION OF INITIATION AND RECEIPT GROUPS

Description	Code number
First number from left: functional role	
Management	1
Employee	5
Non-employee	8
Second number from left: organizational levels	
Levels 1-6	1-6
Third number from left: functional objective	
Line	1
Staff	2
Fourth number from left: functional activity	
Each separate activity was given a separate number in an arithmetic series beginning with "1" at each level	

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FIGURE I – continued

KEY TO CODE NUMBERS FOR IDENTIFICATION OF INITIATION AND RECEIPT GROUPS

Examples:

1613 Operative supervisors at sixth level, saddle factory.

1322 Staff executives at third level.

FIGURE II

FORMULAS DEVELOPED IN THIS PROJECT TO EXPRESS SELECTED COMMUNICATION RELATIONSHIPS FOR INDIVIDUALS AND GROUPS

Group response factor: $\frac{K_g}{R_g} = G$, which is the degree to which a group receives more or less communications than it initiates.

Intensity factor: $\frac{R_g}{(AR)_g \times S} = I$, which is the degree to which a particular sub-group gets more or less than its proportional share of the communications which occur in the overall group.

Multiplier factor: $\frac{R}{Y} = M$, which is the average number of initiations made by each initiation unit.

Propensity to be communicated: $\frac{R - O}{(AR) - O} = P$, which is the degree to which an episode is communicated beyond its organizational origin, within any defined time period.

Saturation factor: $\frac{R}{(AR)} = S$, which is the degree to which the communications received by a unit approach the potential receipts for that unit.

All formulas apply only to conditions of episodic communication channel analysis for an organization, as described in this project.

Key (in alphabetical order):

(AR) --Number of available recipients in unit.

$(AR)_g$--Number of available recipients in sub-unit of overall unit.

K_g --Number of communications initiated by a sub-unit.

O --Number of receipt units included in an episodic communication origin.

R_g --Number of recipients in a unit.

R --Number of recipients in sub-unit of overall unit.

S --Saturation factor (see formula for saturation factor.)

Y --Number of initiation units in a group.

Microfilm $4.20; Xerox $14.20. 327 pages.

1. Simon, Herbert A. Administrative Behavior. New York: The Macmillan Company, 1947, p. 154.

2. Roethlisberger, Fritz J. and Dickson, William J. Management and the Worker. Cambridge: Harvard University Press, 1939, p. 578.

3. Peters, Raymond W. Communication within Industry. New York: Harper and Brothers, 1950, p. 4.

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COLLECTIVE BARGAINING AMONG PROFESSIONAL WORKERS EMPLOYED BY SELECTED NONPROFIT ORGANIZATIONS

(L. C. Card No. Mic 59-2248)

Hazel Simon McCalley, Ph.D.
University of Pennsylvania, 1959

Supervisor: Dr. Gladys L. Palmer

The study was undertaken to determine if collective bargaining by professional workers employed by nonprofit organizations is affected by any unique problems and what role a professional association should assume in seeking economic security for members.

Included are: (1) instrumentalists employed by symphony orchestras, represented by the American Federation of Musicians, (2) ballet and opera artists employed by opera and ballet companies, represented by the American Guild of Musical Artists, (3) social workers employed by welfare agencies, represented by the Community and Social Agency Employees and in a restricted sense by the National Association of Social Workers, and (4) nurses employed by hospitals, represented by the American Nurses' Association.

Data were collected through interviews, questionnaires, correspondence and publications of employer and employee groups. Labor-management contracts were abstracted.

The study surveys the legal status of nonprofit employers and professional workers under the Taft-Hartley Act and state labor relations acts. It describes unique characteristics of nonprofit institutions' structure and financial position. History and structure of each bargaining agent is traced and the experience of each in seeking recognition and negotiating contracts is reviewed.

Except for instrumentalists and performing artists, unions among professional workers in nonprofit organizations are not strong. Although attempts by all four groups to bargain collectively have increased salaries and fringe benefits beyond the level to which they would have gone without such activity, the extent of such gains is below that enjoyed by other unionized workers. Failure to achieve more economic security is due to the deficit position of the employers and in some cases to diffused management responsibilities. Interestingly, both unions and workers tend to identify with the employers' financial dilemma and tend to make minimum demands.

Nurses and social workers, who organize to bargain collectively, are often thwarted in their attempts because of an adverse legal atmosphere. Employers refuse to recognize the bargaining agent because they are not covered by the Taft-Hartley Act and several state labor relations acts. Furthermore, nurses and social workers are difficult to organize. Stress is placed by these two groups on professional status, standards, and ethics. They tend to consider union membership and collective bargaining as unprofessional.

There is inconclusive evidence that management's refusal to recognize bargaining units creates labor strife and bitterness. Instrumentalists and performing artists, because of well established patterns in the symphony and theatrical fields, are not affected by the legal atmosphere. Employer-employee relations on the whole have been amiable. Social workers and nurses, on the other hand, thwarted in attempts to bargain have engaged in strikes

and/or walkouts and considerable bitterness has been evidenced in both the employer and employee group.

The professional association is handicapped in acting as a bargaining agent by the attitudes of its members, its multiple functions, staff and budget limitations and membership policies. The unions representing musicians and performing artists are handicapped by an over-supply of artists and fear lest the employer cease functioning because of financial problems.

Until the financial position of the employing organizations can be improved, and the professionals themselves are more concerned about economic security, professional workers will continue to subsidize the service they perform. Microfilm $5.80; Xerox $20.40. 456 pages.

A STUDY OF PLANNING AND CONTROL POLICIES AND PRACTICES EMPLOYED BY SELECTED AMERICAN COMPANIES, WITH SPECIAL EMPHASIS ON BUDGETING

(L. C. Card No. Mic 58-5091)

Burnard Holmes Sord, Ph.D.
The University of Texas, 1958

Supervisor: Dr. Glenn A. Welsch

Purpose. This dissertation encompasses a record and analysis of the planning, controlling, and budgetary policies and practices of 424 American and Canadian business firms. In addition, this study strives to determine the extent of use and application of budgetary practices currently being employed by modern management.

Procedure. To accomplish the purposes of the study, a list of 820 selected companies was developed. From this list 35 companies were selected for intensive study by direct observation and personal interviews with executives and supervisors. The 35 companies selected are geographically dispersed throughout the United States and Canada, and represent essentially different types of businesses.

Interviews were scheduled at each of the 35 companies with several levels of management. The purpose of this approach was twofold: first, to investigate in depth the planning and control procedures used; and second, to determine the roles of the various levels of management in the planning and controlling processes.

A 4-page mail questionnaire was sent to 780 companies to test the extent to which the reported policies and practices of the 35 companies interviewed prevail; 389 useable replies were received.

Results. The study revealed the following pertinent results relative to planning, controlling, and budgeting:

1. Budgeting is one of the best approaches for obtaining coordination in the utilization of the factors of production--land, labor, and capital--by the individual business enterprise. The study also indicated that the budgeting technique is adaptable to the needs of practically all sizes and types of business. The widespread use of budgeting attests its value as a planning and control technique.

2. Budgeting is more than a mere tool. Budgeting, effectively applied in conformity with the principles and broad patterns of practice revealed by this study, makes possible the maximum delegation of responsibility to successively lower levels of management, and at the same time makes provision for integrated and effective control.

3. The interviews revealed that top management places a real emphasis on active participation in the planning process by all levels of management.

4. The study revealed a distinct pattern of participation in the planning process.

5. Leading companies are utilizing budgeting effectively to motivate individuals to participate willingly and constructively in the management processes.

6. The interviews indicated that before final adoption several levels of management participate in setting standards of performance.

7. The concept of control as it is being followed appears to encompass the following:
   a. Recording and reporting actual performance.
   b. Comparison of actual performance with planned performance--standards, budgets, plans, and/or objectives.
   c. Estimation of future performance.
   d. Corrective action.
      (1) Investigation and analysis.
      (2) Corrective action.
      (3) Follow-up.

8. The control process involves both investigation and follow-up, but the two in reality are separated by corrective action as follows:
   a. Investigation and analysis.
   b. Corrective action.
   c. Follow-up.
      (1) To determine adequacy of investigation.
      (2) To determine effectiveness of the corrective action.

9. A budget program is considered a valuable communications medium. The many conferences, meetings, and contacts involved in developing a formal plan of operations are conducive to a clear understanding of the planned tasks.

10. The budgetary process is extensively used by business firms.

11. The study clearly revealed that the role of lower-level supervisors in the planning and control process is not viewed in the same light by the lower-level supervisors and top management.

Microfilm $6.55; Xerox $22.60. 514 pages.

ECONOMICS, FINANCE

DEVALUATION AND THE BRITISH DOLLAR GAP IN THE POSTWAR PERIOD (1946-1955)

(L. C. Card No. Mic 59-2334)

Nathan Brodsky, Ph.D.
The American University, 1959

The study is devoted to: (1) an analysis of the adverse international economic factors which made solution of the dollar gap difficult during the period 1946 to 1955; and (2) a determination of whether by the end of 1955, a decade

after the end of World War II, Britain had succeeded in creating an international economic position which would aid in closing that gap.

Britain's international financial position and the drains which aggravated her dollar shortage are examined. The interacting forces reflected in the balance of payments data, particularly the impact on the dollar accounts, are analyzed. Several features of the balance of payments during the period 1946-1955 (i.e., trade, invisibles, the balances with the Rest of the Sterling Area and with the Dollar Area) are studied in order that conclusions might be drawn on whether the overall situation tended to create an international position conducive to closing the dollar gap.

Since devaluation was directed toward correcting the dollar gap, its impact on Britain's international position is considered. The developments in exports, imports and prices are compared with the theoretical expectations.

After examining Britain's difficulties in balancing her international accounts, the major impediments to the creation of an international economic position conducive to solving the dollar gap, and the results of devaluation, the future of sterling is considered. Long range problems of inflation, sterling liabilities, low-level reserves, imports and exports, defense expenditures, energy for an expanding economy and convertibility of the pound sterling are discussed.

The study concludes that:

(1) By the end of 1955, a decade after World War II, Britain had not yet created an international economic position which would ensure ability to close the dollar gap.

(2) While the short-run results of devaluation paralleled the theoretical expectations, devaluation did not bring long range improvements to enable Britain to overcome her persistent dollar gap.

(3) There were, however, significant developments in Britain's position during the decade under study which demonstrated considerable economic strength.

Microfilm $2.55; Xerox $8.80. 193 pages.

THE UNITED STATES PARTICIPATION IN THE ECONOMIC DEVELOPMENT OF THE MIDDLE EAST: WITH SPECIAL REFERENCE TO IRAN, IRAQ, AND JORDAN

(L. C. Card No. Mic 59-1786)

Taghi Kermani, Ph.D.
The University of Nebraska, 1959

Advisers: Edward B. Schmidt
Wallace C. Peterson

Despite its potentialities for a more prosperous economy, the Middle East have remained underdeveloped. Extreme poverty, poor health, and widespread illiteracy, together with the shortage of capital, poor technology, and unbalanced institutional structure in the area have created many vicious circles limiting the effectiveness of development efforts. Moreover, the recent awareness of the Middle Eastern peoples of their unfortunate condition and their demands for better living, freedom, and equality, have resulted in a social unrest, which, if continued, may endanger the security and prosperity of the region and perhaps the world.

The economic and social conditions of the Middle East have therefore become a major international concern, especially to the parties of the Western and Soviet blocs. Consequently, the Western nations, realizing that the existing poverty and social unrest in the area provide an excellent breeding ground for communism, have, as a part of their security and economic policies, sought to cope with the problem by helping the Middle Eastern peoples in their efforts for progress.

Among the Western nations, the United States, because of the nature of her economy and because of her recent strategic position among the free nations of the world, has assumed the major responsibility for bringing economic and political stability and progress into the area. This is being attempted through four types of aid programs, utilizing both credits and grants. These aid programs are: (1) military assistance programs to improve the region's political stability; (2) relief aid programs to alleviate distress; (3) economic development assistance to help finance urgently needed projects; and (4) technical cooperation programs to help solve basic economic, social, and administrative problems. However, considering the region as a whole, credits (as a means for supplying capital) and technical cooperation programs (as a means for initiating a self-generating process by helping people help themselves) can be said to be the most suitable forms of the United States contributions in the area.

Through her various aid programs the United States has participated in the economic and social development of the Middle East by helping the Middle Eastern peoples solve their existing problems. She has assisted the Middle Eastern governments to maintain their political stability and bring about administrative and social reforms which are needed for a balanced and steady progress. She has supplied such governments with funds and materials enabling them to cope with their shortage of capital and resources. Furthermore, she has helped such governments design and operate their development plans, thus, giving them the advantages of modern technology.

As the result of the United States-Middle East cooperative efforts, the region, as a whole, is now enjoying better economic and political stability than 1949, and it has shown positive progress in almost every field. It is doubtful that such achievements, at least at the present level, would have been possible without the United States contributions in the area. However, useful as they have been, the United States aid programs in the Middle East are believed to have encountered, on many occasions, several forms of obstacles limiting their maximum effectiveness. An attempt to find and eliminate such obstacles will undoubtedly help make the objectives of the United States aid policy in the Middle East more nearly attainable.

Microfilm $6.70; Xerox $23.00. 525 pages.

THE INTERNAL FINANCING OF CORPORATIONS IN THE UNITED STATES, 1946-1954

(L. C. Card No. Mic 59-1206)

Herbert Eric Sim, Ph.D.
Syracuse University, 1958

In this study, an attempt is made to synthesize the existing elements of a theory of the determinants of corporate saving, elements that have their origin in various deductive analyses and statistical investigations and may be found scattered through the literature. Furthermore, this study inquires into the financing behavior of U. S. corporations during the recent postwar period 1946-1954, with a view toward determining the extent to which U. S. corporations in general and corporations belonging to the several major industrial subdivisions relied upon internal and external funds, respectively, to finance their physical asset requirements during a period marked by nearly continuous prosperity and rapid expansion of physical investment.

The results of the inquiry into the financing behavior of corporations may be summarized as follows:

1) Corporations relied mainly upon internal sources of funds to finance their acquisitions of physical assets during the period 1946-1954.

2) External sources of funds were employed irregularly and to a minor extent, the degree of reliance upon external funds fluctuating with the level of investment, particularly with that of expansion of inventories.

3) Public utilities constituted the only industrial division of corporations relying upon external sources of funds regularly and for a major part of financing requirements, absorbing approximately two-thirds of the external funds employed by all non-financial corporations.

4) Manufacturing corporations, whose physical investment exceeded that of public utilities by 69 percent during the period 1946-1954, absorbed approximately one-third of the externally supplied funds of non-financial corporations.

5) Financial corporations generated internal funds in excess of physical assets growth to an extent roughly equalling the amount by which manufacturing corporations absorbed external funds.

6) Corporations in all other industrial divisions supplied funds on balance to the outside to a minor extent.

The analysis of the financing behavior of U. S. corporations, undertaken in this study, tends to confirm and shed additional light upon a number of theories concerning the determinants of corporate saving. Thus, the analysis supports the view that previous dividend payments and current income are the two factors most influential in determining the level of retained earnings and of the retained earnings ratio. Evidence is inconclusive, however, concerning the effect of expansion programs upon decisions to distribute or retain income.

The results of this dissertation's analysis have a bearing upon several significant questions. One of these concerns the adequacy of outlets for the investments of personal savings. Inasmuch as the analysis points to the conclusion that during periods of prosperity, U. S. corporations absorb only a relatively small part of personal savings, it is clear that personal savings must find investment outlets elsewhere, e.g. in the field of residential housing construction, if high levels of income and employment are to be maintained. Other questions to which the results of this study are relevant, are those of the alleged dearth of equity capital, the role of market forces in allocating capital resources, and the efficacy of interest rate policy in influencing the level of investment.

Microfilm $2.80; Xerox $9.60. 214 pages.

INTERNATIONAL LONG-TERM CAPITAL MOVEMENTS OF THE NETHERLANDS IN THE POST-WAR PERIOD, 1946-1956

(L. C. Card No. Mic 59-2676)

Kornelis Jacobus Walraven, Ph.D.
Syracuse University, 1959

The dissertation analyzes the developments in the international long-term capital movements of the Netherlands during the decade immediately following World War II.

The analysis is mainly concerned with the changes which have taken place in the Netherlands role as an exporter of capital. The discussion leads off with a survey of the different theories of international capital movements which have been developed since the beginning of scientific economic thinking. It is followed by an analysis of the Netherlands foreign-investment position prior to World War II, and proceeds thereafter with a discussion of the effects of World War II upon the Netherlands economy. The reconstruction and recovery of the latter is discussed next, and is followed by a view at the post-war economic role of the Netherlands as an exporter of capital. The dissertation continues with an analysis of the growth of European economic cooperation, and its effect upon the Netherlands balance of payments. The testing of the hypotheses forms the natural conclusion of the study.

Throughout the dissertation stress has been laid upon the interrelationship between domestic economic activity and the capital movements as expressed in the balance of payments. Hypotheses tested were 1) Netherlands exports of capital during the post-war period were mainly undertaken for the purpose of protecting and maintaining pre-war foreign investments, 2) new capital became available for the foreign market as a result of the decreasing marginal efficiency of capital in the Netherlands, 3) loans and grants received by the Netherlands government were in excess of the direct needs for capital necessary to reconstruct the domestic economy, 4) closer economic cooperation among Western European nations contributed substantially to an improvement in the Netherlands balance of payments.

The results of the study show that the first, third, and fourth hypotheses cannot be supported, and must be considered wrong. The second hypothesis proved to be true, but under extraordinary circumstances.

The general conclusion of the study is that the Netherlands has lost its pre-war position as a substantial exporter of capital. Reconstruction of the domestic economy has been financed by capital imports in the form of loans and grants, and of liquidation of foreign assets. The net-creditor position of the country has been maintained, but only to a minor degree. Direct investments continued to expand according to balance-of-payments data, while portfolio investments declined substantially. Purchases of domestic securities by foreigners caused an additional deterioration in the country's net creditor position.

The improvement in the Netherlands balance of payments appears to be mainly the result of the devaluation of the guilder in 1949. European economic cooperation has had little effect upon the Netherlands balance of payments. Microfilm $4.05; Xerox $13.80. 316 pages.

ECONOMICS, HISTORY

CLAUS SPRECKELS, SUGAR KING OF HAWAII: INTERACTION OF AN ENTREPRENEUR WITH AN ISLAND COMMUNITY

(L. C. Card No. Mic 59-2568)

Jacob Adler, Ph.D.
Columbia University, 1959

Claus Spreckels, a California sugar refiner, went to Hawaii in 1876 on the same ship that brought news of the Reciprocity Treaty with the United States. In effect the treaty gave island planters a price increase of two cents a pound on sugar, setting off an economic boom. With his wealth, relentless drive, a thorough knowledge of sugar, and an ability to achieve favorable political alignments for economic goals, Spreckels took maximum advantage of the treaty. He gained control of the Hawaiian sugar industry to an extent not since equaled. Loans to King Kalakaua and to the kingdom were the chief sources of his political power.

By a loan to the king in 1878 Spreckels caused the downfall of a Hawaiian cabinet. A new cabinet granted him certain water rights on the island of Maui. He then built the largest irrigation ditch in the Hawaiian Islands, making possible his Spreckelsville plantation, one of the largest in the world. In 1882, by undue influence over king, cabinet, and legislature, Spreckels obtained title to 24,000 acres of crown lands that he had previously leased for his plantation. Spreckels, King Kalakaua, and the king's chief minister, Walter M Gibson, formed a triumvirate which controlled the Hawaiian government to the middle of 1886.

The Spreckelville plantation was the first link in Spreckel's almost complete control of Hawaiian sugar from growing to marketing. In 1880 he became the partner of William G. Irwin in Irwin and Company. This was soon one of the leading sugar agencies in the kingdom, and thus formed the second link in Spreckels' chain of control. The Oceanic Steamship Company, founded in 1881 by the Spreckels interests, formed the third link. Oceanic dominated the transport of Hawaiian sugar from 1883 to 1900. The fourth link was Spreckels' refinery in San Francisco, the natural market for Hawaiian sugar. Despite abortive attempts by the Hawaiian planters to break this final link in Spreckels' control, he dominated the refining of Hawaiian sugar for the last quarter of the nineteenth century. In 1905 the planters at last established their own cooperative refinery at Crockett, California. Spreckels set the pattern for complete vertical integration still followed by the Hawaiian sugar industry.

Spreckels was also active in Hawaiian finance and banking. In 1883 he became agent of the kingdom to mint $1,000,000 of silver coins in the United States. On this transaction he made a profit of about $100,000. On the day the coin went into circulation, in 1884, he opened the bank of Spreckels and Company, breaking a monopoly of Hawaiian banking held by Bishop bank for over twenty-five years. In 1884 Spreckels also tried to have a bill passed enabling him and his associates to form a privately owned central bank. After a violent controversy, the bill failed. In the disputes over the bank bill and over the coinage, one can sense the beginning of a strong reaction against Spreckels' influence.

In 1886, nevertheless, Spreckels was at the height of his power. He was the chief creditor of the kingdom, holding $700,000 of the $1,300,000 total public debt. A bill was passed to borrow money in London and pay him off. In the resulting break with King Kalakaua, Spreckels' political power was ended. He had economic interests in Hawaii up to his death in 1908, but these could no longer be extended by governmental favor.

The Claus Spreckels story in Hawaii is one of interaction between a mainland interloper and a relatively isolated island community. He became the leader of the Hawaiian sugar industry, the bulwark of the economy. In spite of his ruthless methods, Spreckels was the prime mover in the late nineteenth century economic development of the kingdom. Microfilm $5.50; Xerox $19.20. 430 pages.

ECONOMICS, THEORY

SOME EFFECTS OF IMPORT RESTRICTION ON RESOURCE ALLOCATION AND DEVELOPMENT

(L. C. Card No. Mic 59-2581)

Eirik G. Furubotn, Ph.D.
Columbia University, 1959

The question of whether import restriction can promote economic growth is one aspect of the more fundamental question of how the criteria for factor allocation are to be formulated in order to insure a particular rate of development for an economic system. However, as a result of the emphasis traditionally placed by neo-classical theory on the simpler problem of how to secure an optimal allocation of given productive resources, the view seems to have crystallized than an "efficient" allocational pattern maintained in the present (e.g., free trade) must automatically lead to the most desired developmental path for the future. It is this concept that calls for critical investigation.

One approach to the problem of allocational strategy for a dynamic system is to consider how, and under what conditions, violation of the orthodox marginal rules can accelerate the growth of an economy. There are three groups of variables to be dealt with here. These are: (1) the different possible programs of calculated departures from the competitive allocational plan, (2) the different sets of constraints (connoting various combinations of structural conditions and condition levels), and (3) the different possible growth path objectives (expressed in terms of the sequence of per capita incomes over time that will be accepted by the decision units). If a program and a minimally acceptable growth path are predesignated,

it is possible to determine which sets of constraints, if any, are consistent - in the sense that these sets, and the conditions they imply, permit the specified program to achieve the specified growth objective or better.

In the case of import restriction pursued by an underdeveloped country, a priori investigation suggests that while restrictionist policy may stimulate growth in some circumstances, the environment under which such policy can achieve truly significant effects is difficult to find in the real world. This last result depends not so much on the fact that certain special conditions of the ideal model are hard to meet in practice - although this is true - but on the need for such a multiplicity of conditions to be met simultaneously.

An unorthodox allocational plan together with a favorable set of structural conditions can, at least in theory, stimulate the growth of an underdeveloped country. But if this is so the opposite situation must be examined - i.e., where the competetive allocational acts to retard growth. Under free trade it seems possible that an underdeveloped economy can fall into a "specialization trap" by concentrating productive activity unduly on primary commodities. Then, the actual growth path of the system will not be equivalent to the desired path even though decision units are technically free to shape their own destinies. The fundamental reasons why these two timepaths can diverge are to be found in the differences between private and social costs, in the incomplete knowledge and inconsistent behavior of the decision units, etc. Here, costs of production remain high, markets small and progress limited.

The basic policy dilemma arises because each factor allocation pattern operates on two levels. Current allocation decides not only the magnitude of current output but also helps to determine the values of those elements taken as data in the static case. Thus, the line of action that promotes a maximum product in the present does not necessarily foster "favorable" shifts in the data for the future. This consideration forms the basis for adopting unorthodox allocational plans (like import restriction) because the benefits lost in the short run may be more than made up by the gains attributable to the dynamic reactions which appear in the long run.

In general, there seems to be no allocational plan that possesses inherent superiority over all others. The interaction of the allocational plan and the existing structure of the system generates an actual growth path for the economy; this path may, or may not, correspond with the desired path. Policy should insure that the actual and desired paths are as close to coincidence as possible, but this means that the allocational program has to be free to vary in any degree required and consistent adherence to the marginal principle can not be expected.

Microfilm $3.95; Xerox $13.40. 308 pages.

EDUCATION

EDUCATION, GENERAL

A STUDY OF HOW AMERICAN HIGH SCHOOL SENIORS CONCEPTUALIZE INDIA

(L. C. Card No. Mic 59-2704)

Muthukumarasamy Aramvalarthanathan, Ph.D.
The Ohio State University, 1954

The Study Design

The Purposes of the study were:

1. To determine the critical concepts about India
2. To discover how selected high school students conceptualize India in terms of the critical concepts

The Procedures adopted were:

1. a. Make a content analysis of the writings of selected Americans, such as Chester Bowles, in order to determine critical concepts of a political nature.
   b. Make a content analysis of the chapter "India and the West" from Arnold Toynbee's book, The World and the West, in order to determine critical concepts concerning the historical perspective of India.
   c. Make a content analysis of the writings of selected authors, such as Vincent Sheean, in order to determine critical concepts of a cultural nature.
2. a. In order to obtain a general understanding of how students conceptualize India, secure free responses to the question, "What do you know about India?"
   b. On the basis of the free responses and the critical concepts, develop a questionnaire and administer it to selected student groups.
   c. Analyze the content of student responses.
   d. Make suggestions for teaching about India on the basis of the findings.

Critical Concepts about India

The writer's general hypothesis was that a content analysis of the relevant writings of selected authors would yield critical concepts about India.

The details about the writings used for determining critical concepts of a political nature and of a cultural nature are given respectively in Tables I and II.

In order to determine critical concepts concerning the historical perspective of India, the writer analyzed the chapter "India and the West" from Toynbee's book, The World and the West, and obtained ten concepts.

TABLE I

NO.	AUTHORS	WRITINGS (ARTICLE OR CHAPTER)	SOURCES (MAGAZINE OR BOOK)
1.	Chester Bowles	"Asia Challenges Us Through India"	New York Times Magazine, March 23, 1952.
2.	Adlai E. Stevenson	"Will India Turn Communist?"	Look, July, 1953.
3.	David E. Lilienthal	"Are We Losing India?"	Collier's, June 23, 1951.
4.	William O. Douglas	Chapter 41. "A Girl and a Basket" Chapter 42. "India and Asia" Chapter 43. "Nehru's Welfare State"	Strange Lands and Friendly People, Harper & Brothers, 1951.
5.	Eleanor Roosevelt	Chapter 5. "The Changing India"	India and the Awakening East, Harper & Brothers, 1953.
6.	Norman Cousins	Chapter XIII. "The Hungry Continent" Chapter XIV. "Life at a Bargain Counter" Chapter XV. "Literacy vs. Knowledge" Chapter XVIII. "The Number One Question" Chapter XIX. "The Prime Minister"	Who Speaks for Man? The Macmillan Company, New York, 1953.

TABLE II

NO.	AUTHORS	WRITINGS (CHAPTER OR SECTION)	SOURCE (BOOK)
1.	William O. Douglas	Chapter 44. "Jai Hind"	Strange Lands and Friendly People, Harpers, 1951.
2.	Vincent Sheean	Section II. "What Is the Blessing?" Section VII. "The Appeal to Spirit"	Lead, Kindly Light, Random House, 1949.
3.	James A. Michener	Section entitled INDIA.	The Voice of Asia, Random House, 1951.
4.	Gardner Murphy	Chapter 3. "Village Life as a Source of Security and Solidarity" Chapter 4. "The Rise of Tensions" (Also portions of Chapter 11)	In the Minds of Men, Basic Books, Inc., 1953.
5.	Louis Fischer	No specific chapter	The Life of Mahatma Gandhi, Harpers, 1950.

When the concepts obtained in the above analyses were organized, they produced the following thirty critical concepts about India:

1. The outstanding event in the last five-hundred years of world history is the "encounter between the West and the rest of the world." India experienced this encounter with the West.

2. India, unlike the other parts of the world such as the Middle East or the Far East, was conquered and ruled for nearly two-hundred years; the encounter between India and the West was the most painful and humiliating of all.

3. Indians have vivid memories of their bitter struggle with colonialism and are proud of their newly won independence.

4. The modern history of India and Pakistan is characterized by a conflict between Hindus and Muslims which culminated in the separation of the country into two states, India and Pakistan.

5. The conflict between India and Pakistan still continues, Kashmir being the outstanding issue.

6. The constitution of India accepts the principle of the separation of state and religion.

7. Free India has a democratic system of government. She has adopted the Western ideals of liberty and parliamentary procedures.

8. The present rulers of India are Western-educated, but they are only a small minority of their people and their future is uncertain.

9. The Western outlook and the Indian outlook are different from each other, and the final resolution of the encounter between India and the West is yet to come.

10. Relations between India and Britain are friendly today in spite of their long enmity; India is a member of the British Commonwealth.

11. The partnership between the West and India is very important considering the struggle between Russia and the Western world; the political future of India is of decisive importance to the United States and the free world.

12. Democratic India and Communist China, the two largest nations of Asia, are engaged in an ideological competition in their efforts to bring about economic reconsturction.

13. Nehru, educated in the West and devoted to democratic ideals, symbolizes India and is the most popular spokesman of the people.

14. Communism is alien to the Hindu spirit and will not find acceptance in India under normal circumstances. Lack of economic progress, however, may make the people accept communism.

15. The huge and rising population is a major problem in India. The increasing population pressure on the means of subsistence may make India vulnerable to communism.

16. Food shortage has been a major problem for a long time, and drastic measures are being taken to make India self-sufficient in food.

17. Land reform is very essential for the development of India. It is a problem facing India as well as other Asian countries.

18. Dearth of capital is a major obstacle to economic reconstruction; foreign aid will be useful.

19. India is "poverty-stricken but not poor"; she has enormous natural resources that can be developed.

20. An overwhelmingly large portion of the Indian people live in villages. The village is the basic unit of Indian life where any economic reform should begin.

21. Religion is an important part of Indian culture which has a basic spiritual vitality.

22. The Hindu religion, with all its complex philosophies, symbols, beliefs, and superstitions, is not a fanatic faith; it is tolerant and hospitable to other religions.

23. Gandhi, before his death in 1948, was the greatest power in India and his ideas still continue to have great influence on his people.

24. Gandhi's unique invention was his method of nonviolent resistance or civil disobedience, called "satyagraha." This idea is important not only to India but also for the world.

25. The caste system, an age old Hindu institution, started originally as a practical arrangement of society. and gave position and security to every person. Later it became a social evil. It is breaking down.

26. Indian society is now undergoing important changes; for instance, the joint family system is disappearing.

27. Women are becoming more important and independent.

28. India has twelve major languages and they are a problem in the unification of India. Hindi is the most common language.

29. A large portion of the India people are illiterate; they have knowledge and intelligence, however.

30. Indians have colored skins. Because of their bitter experience with the men of the West, they are color-conscious.

The above thirty concepts, then, are the fruit of the content analysis of the writings of ten American authors and a Western historian.

These concepts were further validated by citing references from such outstanding Indian authorities as Mahatma Gandhi, Jawaharlal Nehru, and Madam Pandit. The next problem was the development of the questionnaire for discovering how high school students conceptualized India.

Construction and Administration of the Questionnaire

Since the word conceptualize was a key word in this study, it became important for the writer to get an understanding of the act of conceptualizing. Hence he made a

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

survey of studies and writings on concepts and concept formation. Much of the traditional philosophical literature and most of the modern psychological studies were found to accept the "common element" theory of concepts.

The writer found the transactional approach of John Dewey, Arthur Bentley, Adelbert Ames and others most appropriate to the present study. This transactional approach (1) does not consider concepts as being "thing-like," (2) does not take a retrospective view of concepts, and (3) does not recognize a dichotomy between perception and conception; they are in a continuum.

Though the study could not deal with the process by which senior students acquired their concepts about India, the writer was able to develop three implications for the construction of the questionnaire. They were: (1) the questions should not be merely specific information questions; (2) the questions should be formulated to relate the Indian situation to the American situation; (3) some questions could be cast in speculative and future terms.

In developing the questions, the writer found two sets of empirical data useful. They were the free responses of sixty-one students to the question, "What do you know about India?" and the comments of ten competent secondary school teachers on the thirty critical concepts.

The basic framework of the questionnaire was determined by the thirty critical concepts. Two short sections contained questions of a general nature.

The schools used for the study were (1) the University School, Ohio State University; (2) East High School, Columbus; (3) North High School, Columbus; and (4) Champaign County Schools, Ohio (Wayne-Woodstock, Westville, and Salem). A total of 230 high school seniors answered the questionnaire.

Conceptualization of India by 230 High School Seniors

Part A. General

Awareness of Distance of India from the United States.—The students overestimated the distance but underestimated the number of days it takes to sail or fly to India.

Knowledge of Location and Size.—About 72 per cent knew that India is in South Asia; a large majority knew that China is the largest country and India the second largest; the students as a whole underestimated the size of India as compared with the size of the United States.

Part B.

Concepts I, II, III.—"The Encounter Between the West and India," "The Conquest and Rule of India," "Struggle with Colonialism and Newly Won Independence"

1. The students had a high awareness of the westward oceanic expeditions like that of Columbus, but a fairly low awareness of the eastward oceanic expeditions.
2. About 73 per cent knew that the British first went to India for trade and later occupied India in order to exploit and make profit.
3. Only 13 per cent knew the exploitative connotation of the word "colonialism."
4. About 60 per cent knew that the leader of the Indian independence movement was Gandhi and that India became independent seven years ago.

Concepts IV, V.—"Hindu-Muslim Conflict and Separation of the Country," "Indo-Pakistan Conflict and Kashmir Question"

1. A majority of the students knew that India is predominantly Hindu and that Pakistan is predominantly Muslim. More than 25 per cent, however, gave opposite answers.
2. Only 35 per cent knew that Kashmir is the name of a state.

Concept VI.—"Separation of State and Religion"

While 91 per cent knew that the constitution of the United States does not support any one religion, the students gave confused responses regarding the secular nature of the Indian constitution.

Concepts VII, VIII.—"Adoption of the Democratic Ideals of the West," "Present Western-educated Leadership"

About 71 per cent knew that India has a prime minister, not a dictator or a king, but the students were not too aware of the democratic system of government in India resembling that of Britain or the United States.

Concepts X, XI, XII, XIII, XIV.—"Friendly Relations between India and Great Britain," "Partnership Between India and the West is Important," "Ideological Competition Between India and China," "Nehru, the Popular Leader of the People," "Communism Opposed to Hindu Religion"

1. Though only 14 per cent said that the relationship between India and Britain today is "unfriendly," about 80 per cent did not know that India is a member of the British Commonwealth.
2. About 63 per cent said that on fundamental principles of political philosophy, Indian leaders are likely to agree with the Western leaders, but the students were ambivalent as to whether Nehru is a democratic or totalitarian leader.
3. About 75 per cent knew that India is a member of the United Nations.
4. About 67 per cent thought that India's possible future change to Communism would be "fatal" or "tragic" or "very great"; they said that India will become communist if the Communists gain control of the government by some means or other, or if the economic situation does not improve, or if India is not helped by other countries, especially the United States.
5. About 47 per cent thought that communism and the Hindu religion are opposed to each other and 23 per cent said that they did not know.

Concept XV.—"Population Pressure"

1. Though in general very sensitive to the population question, the students underestimated the actual number of people in India. As high as 44 per cent said that the population was "199 millions or less," the correct figure being 350 millions.
2. They overestimated the density of population; India was ranked first or second among the following four countries: Japan (584.8), Britain (536.0), India (292.1) and the United States (49.9); they also overestimated the rate of increase in population in India (8.8/1,000) as compared with the United States (13.8/1,000).
3. They had a fairly good knowledge of the fact that India ranks second in the world in respect to size of population.

Concepts XVI, XVII.—"Food Shortage and Measures Taken to Improve," "Need for Land Reform"

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

1. About 87 per cent said that "food shortage is an acute problem in India," but 69 per cent had the misconception that "every year more than a million people die of starvation in India."

2. About 57 per cent knew that "a great effort is being made to increase food production," even though the students were pessimistic about the early realization of national self-sufficiency in food.

3. Only 11 per cent were aware of the problem of "land reform" in India.

Concepts XVIII, XIX.—"Dearth of Capital to Economic Development," "Poverty-stricken but Enormous Resources"

1. According to the student responses, the greatest obstacles to industrial development in India are education, machinery, natural resources, and technical know-how.

2. Even though 87 per cent thought that rapid industrial development would be impossible without aid from outside, only 13 per cent knew what Point Four was.

Concept XX.—"Most People Live in Villages"

About 62 per cent said that a very large percentage of the people in India live in small villages.

Concept XXI, XXII.—"Religion as an Important Part of Indian Culture," "Hinduism as a Tolerant Religion"

1. A large percentage of the students knew that Hinduism and Mohammedanism are the largest religions in India and that Christians are less than 15 per cent of the population.

2. About 45 per cent thought that the attitude of an average Hindu towards people of other religions is either "tolerant" or "friendly."

Concept XXIII, XXIV.—"Gandhi's Great Power and Influence," "Gandhiam Method of Non-violent Resistance"

1. According to the student responses, some of the reasons for Gandhi's greatness were: (1) He won independence for India; (2) He was a powerful leader; (3) He was a religious man and philosopher.

2. Only eight students knew the meaning of "Civil Disobedience."

Concept XXV, XXVI.—"Caste System Now Breaking Down," "Indian Society in Process of Change"

1. The students were very sensitive to the caste system and had a slightly exaggerated view of its evils. About 47 per cent thought that people of different castes do not talk to one another.

2. About 64 per cent said that the caste system is breaking down "slowly" and about 62 per cent thought that Indian society as a whole is changing "slowly."

Concept XXVIII.—"Growing Importance of Women"

About 39 per cent said that some Indian women held prominent positions in public life, while 41 per cent thought otherwise; 30 per cent knew the name of Madam Pandit, the current president of the United Nations General Assembly.

Concept XXVIII.—"Twelve Major Languages"

The students underestimated the number of languages in India. More than 34 per cent checked "three." Only nine out 230 students gave the correct name of the most common language, namely, Hindi.

Concept XXIX.—"Illiteracy But Native Intelligence"

1. Though they generally believe that "most of the people can't read or write," the students underestimated the actual percentage figure for illiteracy. More than 44 per cent checked from fifty to seventy, the actual figure being eighty per cent.

2. About 44 per cent, as against 30 per cent, thought that literacy and intelligence do not necessarily go together.

Concept XXX.—"Color-consciousness"

About 76 per cent correctly said that the color of the people of India is brown. About 55 per cent thought that Indians were not conscious of skin color differences. This is not correct, Indians are color conscious.

Part C.

Important Things About India

According to student responses, the things about India "important for us Americans to understand, "were education, religion, government, living conditions, food problem, population, customs, industry, communism, foreign relations, and caste system.

Self-evaluation of Knowledge of India

As high as 55 per cent said that their understanding of India was "not good," while 50 per cent said "fairly good," and only 3 per cent said "good."

Sources of Impressions of India

1. Within the school, the major sources of their impressions of India were textbooks, classroom teaching, classroom discussion, photographs and pictures, magazines, and newspapers.

2. Outside the school, the major sources were magazines, newspapers, television, movies, radio, and books.

3. Magazines and newspapers obtained higher scores than textbooks.

Suggestions for Teaching about India

1. The thirty critical concepts are all important and worth being used for teaching. The questionnaire may be useful teaching material.

2. The questionnaire findings have furnished for teaching such emphases as the democratic nature of the Indian government and the role of religion in Indian life.

3. Special attention may be given to concepts such as "Population Pressure" and "Food Shortage." The students were found to have misconceptions about them.

4. The high frequency scores obtained by communication media such as magazines, newspapers, television, and movies suggest that the important job of the teacher is not so much to provide the students with more information but rather to help them conceptualize the impressions of India they have received from the media.

Conclusion

A distinctive aspect of the methodology of the study was the critical concepts approach. This approach can be adopted for studying how students of any one country conceptualize another country. Of special interest to the writer will be a parallel research project that studies how Indian students conceptualize America.

Microfilm $3.60; Xerox $12.20. 277 pages.

Abstract published by special arrangement with The Ohio State University.

HEALTH INSTRUCTION PRACTICES AND RELATED ACTIVITIES IN THE JUNIOR HIGH SCHOOLS OF TEXAS

(L. C. Card No. Mic 59-2872)

Frank Anthony Arnold, Ed.D.
The Pennsylvania State University, 1959

Purpose

The purpose of this study was to observe the methodology and determine the extent of the health instruction in the Junior High Schools in Texas. Manifestations of a lack of coordinated effort on the part of the school and the community in the area of good health practices led to the need for such a survey.

Problem

To describe and appraise the present instructional practices in Health Instruction in the Junior High Schools in Texas as measured by acceptable criteria and to suggest recommendations on the basis of the findings.

Procedure

The study was begun in June 1956. The fall of 1956 a series of conferences were held with leading authorities in health education in Texas. This was followed by a presentation of criteria to leaders in the field throughout the country, all of whom responded favorably. Data was collected through the use of a questionnaire sent to 295 Junior High Schools in Texas and interviews were held with educators and health officials within the state.

Findings

A wide variation of instructional practices was observed.

(1) The schools were offering health instruction as part of physical education.

(2) Health instruction was taught one day a week in the majority of the schools offering courses in health.

(3) Those teachers responsible for health courses were not adequately prepared in this area.

Conclusions

(1) There was an overall failure to recognize the function of health instruction courses as they will ultimately be reflected in the health practices of the community.

(2) Supervision of health instruction was frequently performed by persons inadequately trained in the field.

(3) Health instruction was poorly organized as a subject area in the Texas secondary schools.

Recommendations

Future study of the problem should be focused on the organization and administration of the health instruction program.

(1) Better preparation of teachers should be emphasized.

(2) Better use of community facilities and school equipment should be introduced into the schools.

(3) Uniform time for offering health instruction should be enforced by those in authority.

(4) Budget should be made adequate to foster and improve the health instruction program in the Junior High Schools in Texas. Microfilm $3.15; Xerox $10.80. 242 pages.

AN EVALUATION OF THE SCHOLARSHIP SOCIETIES IN CALIFORNIA HIGH SCHOOLS

(L. C. Card No. Mic 59-2607)

Norman G. Arnt, Ed.D.
University of Southern California, 1959

Chairman: Professor Myron S. Olson

The study was made to answer the question, How can scholarship societies in the senior high schools of California be improved? The purposes were threefold: (1) to determine some of the present practices at the various levels of operation of the California Scholarship Federation, (2) to ascertain the general effectiveness of these practices, and (3) to recommend changes which would help to increase the effectiveness of these practices.

Present and past members of the State Board of the California Scholarship Federation (CSF) assisted in establishing standards of evaluation for judging the effectiveness of local scholarship societies. Data were then collected from student members of the Federation, their advisers, and thier high school principals in all parts of the state. Much of the data collected from students and advisers was secured in the form of written comments at meetings and conferences of CSF groups. A letter was sent to the principal of each school having a CSF chapter, requesting his comments. After preliminary groupings, were made, all 12,268 comments were analyzed for consistency of classification, and the reliability of this classification was verified by eight CSF State Board members.

Findings. The major findings indicated that the CSF would be more effective if increased emphasis was placed upon the following: (1) more scholarship society-related activities, (2) more diversified publicity, and (3) more uniformity in membership requirements. Only responses appearing twenty-eight or more times were included in the main body of the study. This provided two or more findings in each of the following categories: (1) the state organization, (2) regions, (3) districts, (4) local chapter administration, (5) student body relations and publicity, (6) semester membership requirements, (7) chapter meetings, (8) chapter activities other than meetings, (9) privileges, recognition, and awards, and (10) preparation for college.

Conclusions. (1) Chapters should be more active and participate in school and community service projects. (2) The CSF should improve its lines of communication and publicity at all levels. (3) Standards for CSF membership should be made more uniform throughout the state. (4) More recognition and honor should be given scholarship society members. (5) Chapters should stimulate more students to greater efforts in scholarship.

Recommendations. To the CSF State Board. (1) Encourage the continued organization and reorganization of districts. (2) Provide for regional and district publicity chairmen to assist the state chairman. (3) Standardize the service requirements so that the point allowed for extracurricular activities represents as much student time and effort as is required for a point in curricular studies. (4) Make a survey of chapters biennially. To high school principals. (1) Select capable CSF advisers who will serve the chapter for a period of years. (2) Permit and encourage advisers to attend CSF meetings. (3) Assist in providing appropriate times and places for local CSF meetings and activities. (4) Mention the achievements

of CSF members and provide for their recognition at awards assemblies, at graduation, and on similar occasions. To chapter advisers. (1) Schedule regular cabinet and general meetings. (2) Encourage worthy chapter activities such as CSF-sponsored assemblies, field trips, and socials, and permit members to serve as tutors. (3) Notify students who are eligible for chapter membership and urge them to enroll. (4) Give students a written statement about the purposes, requirements, organization, and activities of CSF. (5) Provide for a publicity chairman in the chapter constitution and assit this officer in functioning effectively. (6) Prepare and distribute lists of members each semester. To high school teachers generally. (1) Encourage eligible students to apply for CSF membership. (2) Keep a current list of CSF members conspicuously posted.

Microfilm $2.85; Xerox $9.80. 218 pages.

FACTORS CONTRIBUTING TO THE COMPETENCY OF ELEMENTARY TEACHERS IN TEACHING SCIENCE

(L. C. Card No. Mic 59-2805)

Max Joseph Berryessa, Ed.D.
Stanford University, 1959

The problem of this investigation was to identify some factors which differentiated generally competent elementary teachers who carried on particularly effective science programs from generally competent teachers whose science programs were only mediocre.

The specific inquiries which were made were directed toward finding out: (1) if there were significant differences in two groups of teachers with regard to certain childhood experiences; (2) if there were a significant difference between the teachers' traits of authoritarianism of the two groups, as measured by the F-scale; (3) if there were a significant difference concerning the attitudes of teaching between the teachers of the two groups, as measured by the Minnesota Teachers Attitude Inventory; (4) if there were a significant difference between the total hours of college science credit accumulated by one group as compared to such credit accumulated by the other group; (5) if a significant difference existed between the college science course grades achieved by the teachers of one group and the college science course grades received by the comparative group; (6) if there were significant differences between the groups on other factors not already mentioned; and (7) what relationship existed between teachers' interest in science and the kind of science program they developed for their children.

The elementary student teaching supervisors of the University of Utah and the Brigham Young University were asked to identify the outstanding female cooperating teachers with whom they worked. The elementary science program of the 100 teachers so selected were evaluated by each teacher's supervisor and principal, utilizing the Science Program Evaluation Scale which was developed for this study. Only the twenty-five teachers who rated lowest on this evaluation and the twenty-five teachers who ranked in the top quartile were used in the study.

Each teacher was interviewed and completed the F-scale, the Kuder Preference Record, and the Minnesota Teacher Attitude Inventory. The data were treated as follows: (1) T-ratio was employed to determine whether the differences between the Group A teachers' mean scores and the Group B teachers' mean scores on the various instruments used were significant; (2) chi-square and t-ratio were used in determining significant differences between interview responses of the two groups; (3) other responses were compared by using frequencies, percentages, means, and standard deviations; and (4) the Pearson product-moment correlation coefficient was used to determine the relationship between scores on the Science Program Evaluation Scale and the scores on the Scientific Scale of the Kuder Preference Record.

From the findings of the study, it may be concluded that: (1) There was not sufficient evidence to indicate that the childhood experiences of teachers in the study had anything to do with the kind of science program they later developed for their students. (2) The total number of credit hours in college science courses accumulated by the teachers seemed to be a factor in the kind of science program developed by the teachers in each group. (3) The teachers' enjoyment of reading science materials appeared to be a related factor in the kind of science program they developed in their classrooms. (4) The confidence that a teacher had in her supervisor's ability to give her help in the teaching of science to children appeared to be a contributing factor in the development of effective science programs. (5) Those teachers who carried on particularly effective science programs appeared not to have had any more authoritarian traits than those who carried on only mediocre programs of science. (6) There was no evidence to indicate that the grades received by the participants in college science courses had any particular effect upon the kind of science program which each developed for the children in her class. (7) The teachers whose science programs were considered especially effective seemed not to differ in teacher attitudes from those whose science programs were less effective. (8) Those teachers who had developed particularly effective science programs for children had been stimulated considerably more in science and in the teaching of science than had those teachers whose science programs were only average. (9) Adequate room space, facilities, and storage space seemed to be a factor in the development of particularly effective science programs in the elementary school. (10) A teacher's interest in science appeared to be an important factor in the kind of science program she developed for her students at the elementary school level. Microfilm $2.00; Xerox $6.80. 144 pages.

JOB DESCRIPTIONS AND QUALIFICATIONS FOR CAMP LEADERSHIP POSITIONS: A FACTORIAL STUDY TO IDENTIFY FUNCTIONALLY INDEPENDENT CAMP LEADERSHIP POSITIONS

(L. C. Card No. Mic 59-1027)

Jean G. Brown, Ph.D.
New York University, 1958

Chairman: Professor Milton A. Gabrielsen

The purpose of this study is to investigate the qualifications for leadership in resident summer camps in the light of functions performed and draw implications for

developing job descriptions and for the selection of camp leadership personnel. This is undertaken in four steps:

1. The identification of leadership positions in camps and the specific functions performed in each.
2. A demonstration of the relationship between selected positions with respect to the functions performed.
3. A determination of the qualifications desirable for the performance of the functions in each of the position factors identified in sub-problem two.
4. The drawing of implications for the selection of camp leaders in the light of the job descriptions based on the findings of the preceding sub-problems.

It is assumed that the functions performed by staff in various kinds of camps do not vary perceptibly and that in considering qualifications there is acceptance of the educational philosophy that optimum development occurs when there are opportunities for cooperative planning for group living and development of individual interests and skills.

Limitations confine the investigation to functions performed in children's centralized or partially decentralized camps that draw from a physically, emotionally, and mentally normal population.

The procedures used included the use of a rating of the importance of various leadership functions in performing in certain defined positions by a resource board of fifty experienced camp directors, chosen to meet criteria developed to assure appropriate quality of judgment and diversity of interest in camping. The reliability of their judgments ranged between .96 and .98. These ratings furnished the data for determining the relationship between camp leadership positions by means of the product-moment correlation method. The extent of overlapping of these positions was demonstrated when the Thurstons multiple-factor analysis technique was used to isolate three relatively independent position factors.

A jury of six camping experts validated qualifications necessary for performing each function that were developed from the literature and from an analysis of each function.

A logical association of the findings of the study was used to draw implications for the selection of camp leadership personnel.

The conclusions resulting from the investigation are:

1. Six positions receive wide acceptance in camping: namely, director, head counselor, unit leader, activity counselor, general counselor, and junior counselor. These are adapted to meet individual situations.
2. The study reveals eighty-four functions performed by leadership staff in the areas of philosophy, living routines and problems, health and safety, interpersonal relations, program, and administration and evaluation.
3. The factor analysis reveals three position factors. Factor A is guidance with heavy loadings for the positions of activity, general, and junior counselors. Factor B is a supervision factor with the positions of head counselor and unit leader closely related. Factor C, an administrative factor, has only one significant loading, that of director.
4. In considering the functions important in positions with significant loadings in each of the three factors, there are functions that are common to all factors, some that are unique in each factor, and some that are present in two factors.
5. An analysis of the qualifications required for each factor or for each position indicates a multiplicity of requirements with a high degree of "sameness" in the personal characteristics and somewhat more specificity in the educational requirements.
6. The findings of the study warrant implications for selection of staff in two areas. One deals with the need for an awareness of the high requirements for effective leadership with the resultant need for care in selection, and for good pre-camp and in-service training to supplement the qualifications staff possess. Another area of implications center around staff organization. Since the factor analysis reveals three independent position factors, it is possible to simplify camp organization by reducing the positions to coincide with the three factors: namely, guidance, supervision, and administration.

Microfilm $2.15; Xerox $7.60. 162 pages.

THE ROLE OF HOME ECONOMICS IN DEMOCRATIC FAMILY LIVING WITH REFERENCE TO CHILD WELL-BEING AND PROPOSALS FOR SUCH EDUCATION IN THAILAND

(L. C. Card No. Mic 59-2556)

Davirashmi Dhanagom, Ph.D.
The Ohio State University, 1954

The welfare of a society depends on the well-being of its citizens, especially children, the adults of tomorrow. The child's health, his physical and mental well-being, is of particular significance to society. Believing that it is the responsibility and privilege of the family to cultivate a healthy child through democratic family living and that home economics is one of the several areas of education which promote sound family life, the writer undertook the present study to discover the needs and make proposals for such education in Thailand.

The major purpose was to propose means of further preparing parents and prospective parents in Thailand for competent parenthood in light of the recognized needs and accepted principles of child care and guidance.

The study was based on the hypothesis that the basic principles of child health and the concepts of healthy parent-child relations as accepted in the United States provide bases for developing proposals for education for family living which will be accepted as essential in meeting present-day needs in Thailand.

The study was based on certain assumptions. A healthy personality is important for a successful society, for only healthy people can live happily, comfortably, and effectively and only healthy people are capable of self-direction in meeting the persistent tasks of life. Since a child's development begins at his conception and since the patterning of his personality is laid in his early years, the family, as the agency of child-bearing and the prime agency of child rearing, has a primary role in the development of a healthy personality. Through healthful family living and wholesome parent-child relations, a child has the greatest chance to develop a healthy personality. Home economics plays an important role in child health and well-being, since the primary objective of home economics

is educated for individual and family well-being. Since Thailand has advocated democracy and it is interested in improving child health through various approaches, one basic approach may well be through home economics education which emphasizes family life. To be healthy and health-minded Thai children must be brought up by health-minded parents. Education for competent parenthood must be planned in light of an analysis of the existing needs of Thailand.

Twelve generalizations interpreting present-day concepts of healthy parent-child relations were developed after an extensive survey of literature in the field of child development and parent-child relations in the United States. The scope and nature of home economics were examined for the purpose of determining the relation of its primary objective and content to the promotion of individual and family well-being. The nature of sound programs of teacher education in the United States and the role of government agencies and professional organizations in promoting home economics programs were studied.

Current materials on Thailand available in the United States as well as many from Thailand were investigated, with particular attention being given to needs and developments related to child health. In light of needs and the generalizations developed concerning healthy parent-child relations, a list of 45 principles basic to family life education was formulated. A check list inquiry in Thai was developed and sent to a jury of 33 Thai leaders. Respondents were asked to indicate the most serious health problem(s) in Thailand, suggestions for meeting health problem(s) and whether home economics could be effective in meeting such problems. In addition each of the educational principles was to be checked as to its importance for parents and prospective parents, and, if it were important, whether it would be an appropriate goal for teaching in the schools and/or for adult education.

Respondents were grouped as teacher educators, physicians in health education and health development, home economists, administrators in the Ministry of Education, and others to determine whether professional preparation and present occupation influence response.

Implications for home economics instruction in Thailand were drawn in the light of (1) what the majority of the jury members considered the most serious health problem(s); (2) their suggestions for promoting education for child well-being; (3) their belief as to the contribution of home economics teaching in meeting the needs of Thai families and children; and (4) the suggestions regarding the 45 principles.

From the pertinent literature certain fundamental concepts regarding what constitutes child well-being and how it is best achieved were developed. Health, the result of physical, emotional and intellectual well-being, consists of maturity, the capacity for adjustment, the ability to live happily and effectively, and the ability to develop to the fullest potentiality. Intelligent associated living promotes such development. Important elements are free thinking, understanding, common concerns, common interests, purposive and joint enterprises, all of which are the outgrowth of fraternity, liberty, and equality. The changing dynamic life of today necessitates adjustment and readjustment to environment, physical and social. The healthy individual has this capacity and hence functions democratically in associated living. The family can provide rich opportunity for such experience. Its daily practice of democracy thus defined can cultivate a healthy personality. Its functions in childbearing and child rearing are socializing and culturizing the child.

The family is the only institution which can meet the basic needs of the child, physical well-being and emotional security--that is, to love, to be loved, to belong, to have a sense of individual worth, self-confidence, and success. Meeting these needs in the early years of life is laying a sound foundation for a healthy personality, participating citizenry, and responsible parenthood.

In intimate family living the parents' influence upon the child's personality is great; healthy parent-child relations are essential for achieving healthy personality. The foundation is laid in husband-wife relationships before the child is born and their willingness to take responsibilities in child rearing. Fundamental to the child's development are the parents' knowledge of heredity and environment in relation to the child's potentialities of growth, of different patterns of growth, growth rate, rhythm, and sequences of growth, and their understanding of the role of the child's play and ability to provide appropriate environment essential in promoting over-all optimum growth. Parents need to understand that good heredity, good physical health, good medical care plus affection, legitimate praise, and consistency in the sense of freedom from rapid, unpredictable change in affection, discipline, care, and protection contribute to the child's mental health. Parents need to help the child form his self-concept and patterns of behavior. Parents' attitudes are contagious and the child's wholesome attitudes toward sex may therefore be promoted by them. Most important are an adventurous spirit in facing the problems of life and an understanding of what a real problem is; to understand that a problem "has a history" and that there is no one formula in solving any problem, is a great help in family living.

Study of home economics programs in the United States revealed the primary objective of home economics to be education for effective family living. Home economics functions at all educational levels. It contributes to nursery school, elementary school, high school, university and adult education programs. At the college level, home economics provides education for personal development as well as for professional leadership training. It is open to both sexes, though at present the number of boys and men in this field is limited.

There is a definite effort to develop more functional programs of home economics to meet the needs of the pupils, their families and communities. The trend is to focus learning and teaching on factors affecting family living and family well-being. Such areas in home economics as child development and family relationships, textiles and clothing, foods and nutrition, home management and family economics, and housing including furnishings and equipment, can be learned and taught with emphasis on improved human well-being through satisfying human relations and home life. Such an emphasis necessitates consideration of the entire life cycle of the family and of all family members; different socio-economic backgrounds; and varied conditions under which families live; it further requires an understanding of human growth and development, behavior and character.

Analysis of data on Thailand today, showed certain educational needs related to family well-being. Education for better living is urgently called for in Thailand. Various avenues can be used to attack health problems. To

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cultivate a health-minded people is one of the best means. The families of the nation and the heritage they give to their children are central to the problem. Educating family members for healthful family living and helping them to achieve wholesome family life are major challenges to education.

Thailand is a tropical country, the main income of which comes from agriculture. Since Thailand is not industrialized, many manufactured products have to be imported. Neither coal nor natural gas has been found; therefore manpower is very important. The government changed in 1932 from an absolute monarchy to a constitutional monarchy; there is evidence of interest in moving toward democracy. Many concepts of Feudal Siam still persist, concepts which are contrary to democratic ones. To do away with these, education is necessary to develop good leaders and good followers, so that all can contribute to the best of their ability to the welfare of the whole.

Lack of knowledge of simple health practices in everyday living and of the knowledge of communicable diseases accounts for the prevailing ill health of the nation at large. Though high infant mortality rates have declined recently, a nation-wide campaign to combat disease and promote health is called for. Ill-health is an economic burden and a social waste.

An analysis of the political, economic, social, and educational situations in Thailand shows that some attempt has been made to promote child health and well-being. Such recent developments as studies of nutrition and of maternal and child health, as well as the establishment of juvenile courts are evidence of an increased concern for the welfare of children. However, only as the family is aware of and uses such resources can such attempts succeed. Only as education of family members in relation to child needs takes place will these agencies be able to function effectively.

Many fields of education make contributions to healthful living. But it is through educating women in the homes and making them realize the importance of health practices, that health principles will function in daily life and children will have a real chance for healthy all-round development. It is the thesis of the present study that home economics should be so developed that it will contribute to such education.

The list of 45 basic understandings and abilities proposed as important for Thai parents and prospective parents to develop if child well-being is to be promoted includes 18 items which relate to child guidance with emphasis on both physical and mental health from the time of conception to maturity; 11 which touch such aspects of family living as provision and consumption of food, clothing, and shelter with emphasis on sound home management and family economics; five which are concerned with marriage and the responsibility of performing one's sex role in the guidance of children; and 11 which stress the need for better health laws and the importance of respect for the human personality in family living and in promoting shared responsibility in cultivating the health of others in and outside the family.

It was believed that the extent to which their leaders would accept such principles as important to the country's educational needs would have implications for the development of a home economics program.

A majority of the Thai leaders who were requested to appraise these principles accepted them as important educational goals. There was a response of 83 per cent. Most favorable response was given to the principles as important for parent education. One item had a one-hundred per cent approval as an educational goal for parents; 32 other items were approved by from 75 to 99 per cent of the group, and 12 other items were approved by over 50 per cent. As goals for instruction in schools 9 items received approval by 75 per cent or more respondents, and 19 more items were approved by over 50 per cent. The other 17 items were approved by less than 50 per cent. The respondents' interpretation of the word "schools" undoubtedly had an effect on their willingness to check items as goals to be taught in schools. As goals for adult education, 23 items had 75 per cent or better of the group approving, 22 other items had the approval of 50 per cent or more. Thus more people approved of the principles as goals to be taught adults than to be taught children. Some respondents remarked that the principles could and should all be goals in schools, particularly in high schools.

As goals of parent education, the 12 items which received over 90 per cent approval are concerned with understandings and abilities related to the intangible aspects of child rearing. The 18 items which were approved by 80 per cent deal with the more tangible aspects of living, such as food, clothing, and shelter. The five items which received the least approval are those understandings which help individuals to see their responsibility to the welfare of the whole. It is noteworthy that item 35, "Belief in the sacredness of the human personality must be implemented before its political implementation can be fully achieved," is in this group. It may be that in light of the situations in Thailand, this is too abstract to be of great concern at present.

Most respondents saw the health problems as perennial, complicated, and interrelated. Problems were classified as educational, social, geographical, and legislative. The problems mentioned by more than 50 per cent of the respondents were: ignorance of simple health knowledge, careless food habits, too highly seasoned food, little sanitation, exclusion of nutrition from the curriculum, and theory without emphasis on practice. These problems are similar to those revealed from the analysis of available literature on Thailand.

The suggestions of most members gave evidence of the need for new methods of teaching in health education. Many seem to think of health only in terms of physical health. It was pointed out that the effectiveness of such education rests on the education of the parents so that they can understand school programs and coöperate with teachers. Coördination of the existing services for better health service to school children, better preparation of teachers, and improvement of environmental sanitation were stressed. It was agreed by three leaders that health education should be based on the principles in the check list.

The members expressing attitudes favorable to home economics as a factor in promoting parent education for child care and as an effective means of meeting the needs and problems were not as many as those who accepted the principles as educational goals. It is evident, however, that some persons did not recognize these goals as appropriate goals of home economics because they hold a very narrow concept of home economics. This is a great challenge. Sound interpretation of home economics as a means of meeting health needs and promoting physical and emotional health is urgently needed.

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It was concluded that the findings support the hypothesis that basic principles of education for healthy parent-child relation may serve as sound bases for meeting the present needs of Thailand. Further it is believed that home economics should be developed along lines which will enable it to meet such needs in cooperation with agriculture, other areas of education, and health agencies.

There is need to improve public education affecting healthful living and parent-child relations in order to raise the physical and mental well-being of the Thai children and to emphasize the concept of parental responsibility for the child's development. Home economics, through promoting the 45 principles formulated in this study, in cooperation with other areas can help to meet this urgent need. To be effective, attack needs to be made at all levels, in elementary and secondary schools, in colleges, and in adult education programs both in schools and at the community level through extension work.

A national conference is an important first step toward orienting the country to the need for and the nature of home economics. An advisory commission should be appointed at the national level, with subcommittees to extend and strengthen curricula in schools and colleges, plan short courses for leadership training, and promote in-service education through lectures, visits of experts, workshop, and other measures. Higher institutions must assume the responsibility of setting up sound programs for preparing leadership personnel.

Health, agriculture, and education should collaborate at the community level in giving pilot demonstrations on the improvement of family nutrition and sanitation at low cost to promote healthful living and improvement of family living through better use of existing resources. Thus, family living can become increasingly effective in developing healthy citizens who will be capable of meeting the responsibilities of a democracy.

Microfilm $4.10; Xerox $13.80. 319 pages.

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THE RELATION BETWEEN ARITHMETIC RESEARCH AND THE CONTENT OF ELEMENTARY ARITHMETIC TEXTBOOKS, 1900-1957

(L. C. Card No. Mic 59-2611)

Sister Marie Constance Dooley, R.S.H.M., Ed.D.
University of Southern California, 1959

Chairman: Professor Perry

The purpose of this study was (1) to note the degree of connection between the recommendations of scholars who carried on scientific investigations in arithmetic and the changes that had been introduced into the content of arithmetic textbooks and (2) to check the recommendations which seemed to have been rejected by authors of textbooks, although presented as substantiated, credible findings based upon scientific investigation in order to (3) determine the status of arithmetic research in the curriculum program and (4) isolate, if possible, reasons for the gap between recommendations for changes in teaching methods and the application of these recommendations.

The following questions were proposed: (1) Are research recommendations finding their way into textbooks and at what rate? (2) Can reasons be identified to explain the acceptance of some and the nonacceptance of other findings? (3) Are those techniques which have been tried out experimentally and found successful generally recommended? (4) Are any techniques recommended before they have been tried out experimentally? (5) Is there a time pattern which is generally followed?

An over-all review of the available literature on the research studies in elementary arithmetic was made to determine the trends that had developed in content and method since 1900. Two lists were compiled, one with topics which seemed to have been definitely influenced by research recommendations, another containing topics which apparently had not yet been greatly influenced by research. A list of twenty-five topics was compiled from which a national jury of experts chose twelve for this study. A survey was made to locate the research recommendations and critical opinion on each of these twelve topics. This was followed by the examination of 153 series of elementary arithmetic textbooks published in the United States by twenty-nine different publishers between 1900 and 1957.

Conclusions. The effect of research upon the content and methods of arithmetic was found to have been direct and immediate in nine instances. (1) The method of placing the decimal point in the quotient was accepted in 1917 following research recommendations, but a slight trend (2) has developed since 1946 when critical opinion reappeared in the literature. (3) Imaginative settings for verbal problems, (4) elimination of awkward, unrealistic fractions, and (5) the use of illustrations as visual aids are applications of research recommendations. (6) The common denominator method is used to introduce the process of division of fractions. (7) Tests designed to measure concept and (8) suggestions for using materials which should contribute to the development of generalizations are being incorporated into textbooks, but authors are cognizant of the fact that (9) the choice between the two usual methods of estimating the true quotient has never been determined by scientific investigation.

In three instances recommendations have been rejected to some degree: (1) The suggested grade placements of long division and of common fractions were not accepted, and modifications were necessary before changes were made in textbooks. (2) Authors have continued to recommend the use of concrete materials in middle and upper grades, even though research data have not been significant. (3) The use of the common denominator method in division of fractions has been limited to introductory use rather than to full development as a method.

Most research in this area has been designed to evaluate practices already in use. Incorporation was found to have been rapid when the recommendations were clear, concise, and exact. Trends took longer to develop when the recommendations were general, intangible, or based upon subjective data. With one exception, the use of concrete materials above the primary grades, recommendations published in yearbooks tended to be applied quickly. Trends were found for all topics in this study.

Implications and Recommendations. This study has shown that authors of textbooks have been aware of and have applied research recommendations, have been selective, and have been influenced by the group approval implied by publication of research in yearbooks. The need for constant re-evaluation has been pointed out and further

research recommended, along other lines, to determine the cause of the lag in arithmetic progress.

Microfilm $5.40; Xerox $19.00. 422 pages.

A STUDY OF DESEGREGATION PROBLEMS THAT MAY AFFECT THE INSTRUCTIONAL PROGRAM OF JUNIOR HIGH SCHOOL INDUSTRIAL ARTS IN NORTH CAROLINA

(L. C. Card No. Mic 59-2886)

Thomas J. Haigwood, Ed.D.
The Pennsylvania State University, 1959

The Problem

The purpose of this study was threefold: (1) to determine whether real differences exist in the seriousness of certain instructional problems in junior high school industrial arts in the Negro and white segregated schools of North Carolina and the Negro and white segregated and desegregated schools of the border states (Delaware, Kentucky, Maryland, Missouri, Oklahoma, West Virginia, and the District of Columbia); (2) to determine whether there were differences in teachers' opinions on the effects and the expected effects of desegregation on certain instructional problems in the above-mentioned schools; and (3) to study some of the practices and techniques used by successful teachers in the instruction of desegregated classes of junior high school industrial arts.

Three questionnaires were used in the collection of the data for this study:

1. Four hundred and two junior high school industrial arts teachers employed in the segregated and desegregated schools of the border states and North Carolina responded to a questionnaire in which they rated the seriousness of certain instructional problems in their classes.
2. Three hundred and sixty-six of the same teachers who had responded to the first questionnaire participated in a second questionnaire in which they rated the effects and the expected effects of desegregation on certain instructional problems in industrial arts.
3. Thirty-six teachers employed in desegregated schools of the border states, who had been recommended by their local supervisors for superior work with desegregated classes, responded to a free-response questionnaire on successful practices in the instruction of desegregated classes in industrial arts.

Conclusions*

1. The Negro segregated junior high school industrial arts programs of North Carolina have more serious instructional problems than the white segregated programs of North Carolina.
2. The desegregated junior high school industrial arts programs of the border states have more serious instructional problems than either the Negro or white segregated programs of the border states.
3. The teachers in the desegregated junior high school industrial arts programs of the border states have experienced a greater increase in instructional problems, due to desegregation, than is expected by the teachers in either the Negro or white segregated programs of the border states.
4. Successful teachers in desegregated programs of junior high school industrial arts make three recommendations for coping with instructional problems in desegregated classes: (1) plan the course content to take care of a wider range of abilities and backgrounds, (2) a more tolerant attitude by the teacher toward Negro students, and (3) more teacher and less student control of class activity.

Microfilm $3.20; Xerox $11.00. 248 pages.

*Not complete, only some of the more important conclusions.

THE NATIONAL SOCIAL SORORITY: ITS ADMINISTRATIVE RELATIONSHIPS AND THE SCOPE OF ITS ACTIVITIES ON THE CONTEMPORARY COLLEGE AND UNIVERSITY CAMPUS

(L. C. Card No. Mic 59-1210)

Jo Ann James, Ph.D.
Syracuse University, 1958

This study examines these aspects of the national social sorority: current picture on college and university campuses in the United States; nature of the sorority; relationships between groups working with sororities; and trends in sorority policies, activities, and relationships. Data was obtained from sorority publications, current literature, and questionnaires returned from 86.88 per cent of the women personnel administrators (deans) on campuses where sororities were located in 1954-1955 and from 54.84 per cent of the national offices of the 31 sororities making up National Panhellenic Conference in 1954-1955.

The first social sorority was organized in Georgia in 1851. By 1954-1955, over 1,700 chapters of this and 30 other national social sororities had been established on 221 campuses in 47 states and in the District of Columbia. Each of these sororities is organized geographically by provinces with officers responsible to a national office. Each of the 31 sororities is represented in a National Panhellenic Conference; and each undergraduate chapter of a national sorority is represented in a campus Panhellenic coordinating group. Although local undergraduate chapters are part of a national organization, they are also a part of the activity program on their respective campuses. As such, they are responsible to college and/or university administrations and subject to the rules and regulations of their respective institutions, including student governments.

College and university administrations exercise supervision through eligibility requirements, review of sorority budgets, advisement of campus Panhellenics, and work with sorority head residents. This study shows that there is good cooperation between the personnel of sororities and the administrative personnel of institutions where they are located.

This study reports that national social sororities seek to develop in the individual member an appreciation of beauty, a sense of responsible citizenship, an understanding of group and individual interrelationships, admirable personal qualities, and scholastic achievement above minimum college and university standards. This study does not measure the extent to which sororities reach their stated goals. It does, however, point out some of the

sorority's contributions which indicate apparent success in some areas.

For example, a high percentage of both deans and sorority national officers indicate they feel sororities contribute to social education on their campuses. A large proportion of each group feels sororities contribute to a healthy spirit of competition, campus spirit and morale, and community service.

The deans and national officers also point out several problems which sororities create on campuses. They are concerned with student opinion regarding the prestige of undergraduate chapters. The students who rush sororities but do not pledge one appear to be a problem to both deans and national officers, although this study indicates a high percentage of rushees is pledged. About a third of both groups indicate that alumnae pressure and campus politics are problems. The national officers indicate that illegal rushing is a problem. Almost half of the deans point out that the added expense of sororities is a problem.

In summary, several statements are made concerning the present status of the national social sorority. The study points out features which indicate that sororities now place emphasis on personal qualifications of the individual rushee rather than on students' prestige and family background. It strives for uniform standards of organization and practices in all undergraduate chapters.

There is some evidence that sororities achieve the goals which emphasize the sorority's interest in the academic and personal development of individual members. Panhellenic organizations, as coordinators of sorority programs, hold important and significant positions on both the national and local scene.

It appears from the expressed opinions of women personnel administrators in American colleges and universities that the national social sorority will maintain a position of importance in higher education for some time.

Microfilm $4.15; Xerox $14.00. 322 pages.

THE EFFECT OF AWARD, ADULT STANDARD, AND PEER STANDARD UPON THE CREATIVENESS IN ART OF HIGH SCHOOL PUPILS

(L. C. Card No. Mic 59-2904)

John Arthur Michael, Ed.D.
The Pennsylvania State University, 1959

The purpose of this study is to determine what effect certain external influences used in an otherwise normal teaching situation have upon the creativity of the pupil. Thus the problem, specifically limited, is: the effect of award, adult standard, and peer standard upon the creativeness in art of high school pupils.

This study was carried out in two schools in Cincinnati, Ohio--Hughes High School and Western Hills High School --during the 1957-58 school year. Six art classes, selected at random, served as the experimental groups, the groups with which the various predetermined external influences were introduced. Two other art classes served as the control group handled in a normal manner. Two teachers were involved, one in each school. Each teacher had three experimental classes and one control group.

During a four week period beginning with the second week of school, typical and normal art instruction (no external influences) was given in each of the eight art classes in the experiment. In the second phase of the experiment, the six weeks following the first four weeks, the influences --award, adult standard, and peer standard--were used in each of the three experimental classes of each teacher. No predetermined influences were used in the control classes. Following the experimental six week period was a four week period of normal art teaching when no predetermined influences were used.

After each of the three periods, four measures were used to determine creativeness in art of the pupils. The first measure, the art products, were evaluated by judges (art educators) using a visual art scale. The second measure, the Uniqueness of Self Concept Scale, an adjective check list developed by Burkhart, was used to determine the creative level of the pupil as noted by his attitude during the art work period.[1] The third measure, the High School Art Work Preference Test (developed within the framework of this study), indicates the pupil's preference for art work of his peers. The fourth measure, the Art Acceptance Scale developed by Beittel to determine attitude when looking at a reproduction of a painting, was also given to all pupils at the end of each of the three periods.[2]

The following conclusions may be drawn as a result of the t-values, ^{t}mean gains values, and Spearman rank order coefficients of correlation:

1. The influences did not contribute but were detrimental to growth and development as seen in the aesthetic quality of the art products.
2. The influences appear to retard or prevent the normal growth and development of the pupil's concept as he works on his art products as shown by the Uniqueness of Self Concept Scale.
3. The influences did not affect art acceptance as indicated by the Art Acceptance Scale. The influence of award and adult standard did adversely affect art acceptance within each of these groups, the post-experimental period compared with the pre-experimental period.
4. The influence of award and peer standard appeared to bring about a greater consciousness for the final art product as shown by the High School Art Work Preference Test.
5. The influences appear to discourage the use of the more flexible trial and error approach in favor of the rigid preconceived approach to creativity. Suggestions were found to be more helpful and art products were of a higher aesthetic quality when using the trial and error approach.
6. When influenced by an adult standard of cubistic-to-abstract reproductions, pupils tend to work beyond their normal level which, if continued, may develop into a duplicity of styles. Microfilm $2.55; Xerox $8.80. 194 pages.

1. Robert C. Burkhard, "An Analysis of Individuality of Art Expression at the Senior High School Level" (unpublished Doctor's thesis, The Pennsylvania State University, 1957), pp. 79-85.
2. Kenneth R. Beittel, "Some Experimental Approaches to the Aesthetic Attitudes of College Students" (unpublished Doctor's thesis, The Pennsylvania State University, 1953), pp. 98-178.

A STUDY OF READABILITY AND OTHER FACTORS OF SELECTED BUSINESS COMMUNICATIONS

(L. C. Card No. Mic 59-2939)

Dean Andrew Peterson, Ed.D.
University of Southern California, 1959

Chairman: Professor Finn

The purpose of this study was to determine the readability of selected business communications as measured by the Gunning and Flesch readability formulas, the relationship between readability and jury ratings of the communications, and characteristics of the communications. A secondary purpose was to compare the two readability formulas and to examine the factors which influence the results obtained with each.

Copies of three hundred business letters from fifteen Utah companies were obtained for use in the study. A jury of five business communications specialists rated the letters, determining the best 20 per cent and the poorest 20 per cent. The two groups of letters were analyzed for readability and other factors. Comparisons of the two readability formulas were also made.

Findings. (1) With the Gunning formula the best letters had a mean readability index of 11.65 and the poorest ones an index of 12.67. The best letters were eleventh-grade level, and the poorest were twelfth-grade level. The critical ratio was 2.36, which was significant beyond the 5 per cent level of confidence. (2) With the Flesch formula the best letters had a mean readability index of 54.84 and the poorest ones an index of 51.42. The best letters were approximately tenth-grade level, and the poorest were approximately eleventh-grade level. The critical ratio was 1.44, which was not quite significant at the 5 per cent level of confidence. (3) There was a positive correlation of .72 between the readability indexes obtained with the two formulas. (4) Correlation of the Gunning formula factors and the obtained readability scores were: average sentence length, .74; vocabulary load, .55. (5) Correlations of the Flesch formula factors and the obtained readability scores were: average sentence length, .27; vocabulary load, .93. (6) Some observed characteristics were: (a) 49 of the best letters and 27 of the poorest followed an organizational plan; (b) the best letters averaged 168 words, and the poorest averaged 94; (c) all 60 of the best letters and only 28 of the poorest ones contained a positive tone; (d) 25 of the best letters and 37 of the poorest contained major punctuation errors; and (f) 8 of the best letters and 31 of the poorest contained stereotyped expressions.

Conclusions. (1) The readability index, as measured by the Gunning formula, was a significant factor in business communications. (2) Although the Flesch formula produced results similar to those of the Gunning formula, they were not quite so conclusive. (3) Both readability formulas measured relative readability. (4) With the Gunning formula the sentence length was the more important factor; with the Flesch formula vocabulary load was more important. (5) The business letters averaged between tenth- and twelfth-grade levels of readability. (6) In addition to readability, several other characteristics were associated with business letters of varying quality.

Recommendations. (1) Business communications consultants and teachers should instruct in the appropriate use of readability formulas. (2) Emphasis should be placed upon such important characteristics as planned presentation, conciseness accompanied by clearness and completeness, positive tone, proper use of mechanics of writing such as grammar and punctuation, and avoidance of stereotyped expressions. (3) Further study should be undertaken to determine the relationship between readability and such factors as the educational background of the writer, kind of business, size of business, and in-service communications programs. (4) Further study should be undertaken to develop improved readability formulas. These might include, in addition to sentence length and vocabulary load, such elements as the number and kinds of ideas expressed, suitability and interest of subject matter, and organizational devices. With electronic equipment it should be possible and practical to use multifactor formulas to obtain readability measurement of greater significance than provided by present formulas.

Microfilm $4.05; Xerox $13.60. 315 pages.

THE ACTIVITIES OF BUSINESS AND INDUSTRY TO IMPROVE SCIENCE EDUCATION

(L. C. Card No. Mic 59-2808)

Robert Bruce Sund, Ed.D.
Stanford University, 1959

Problem

The purpose of this study is to identify the role business and industry have taken in improving science education in the public schools of America from 1949 to 1958. Specifically, the study examines suggestions expressed by business-industry pertaining to the philosophy and objectives of science education, curriculum modifications, teaching practices, recommendations for special education (gifted, vocational and technical), teacher training, and credential recommendations and determines trends in these areas.

Sources of Data

The sources of data are from reports, programs, and talks published by various industrial and business concerns, and professional articles in science education from industrial and professional journals, summaries of industrial and educational conferences and conventions, pertinent books, personal interviews, and conversations with individuals involved in the business-industry education programs for the improvement of scientific education in the public schools.

Conclusions

The following conclusions are indicated by the data: Since World War II the educational programs financed by business-industry for the improvement of science education have been increasing in number. Business-industry have been primarily interested in developing more manpower in the physical science fields. They have constituted various permanent committees and councils for the purpose of improving the standards of science instruction as a means to this end.

Business-industry have supported the following: Teacher Training: 1. They have sought to alleviate the shortages of qualified science teachers by sponsoring in-service educational programs devoted to the improvement of subject-matter backgrounds of the teachers. These include seminars, summer employment, and institutes at colleges or universities. 2. Business leaders have criticised the credential requirements for teachers because they believe this reduces the number who might go into science teaching. Philosophy: 1. They are specifically concerned about gifted students and think they should be given special attention. 2. The high school needs a better balanced program including more science for its students. 3. It is important to locate students with scientific potential earlier in school. 4. Science instruction at all levels needs more attention given to experimental activities. Objectives: There needs to be greater emphasis given to problem solving and creativity. Laboratory: 1. They have tried to replace "cook-book" experiments with a more "open-ended" type. 2. Laboratory equipment in schools should be improved. 3. Some industries give special equipment to the schools for laboratory work. Teaching Aids: 1. The majority of aids developed by business are for the physical sciences. 2. A variety of teaching aids are provided by industry for science teachers to counsel students into science. Teaching Techniques: 1. Business-industry have been instrumental in increasing science fairs by more than four times since 1950. 2. Integrated lecture-demonstration teams and science assembly programs have been developed by businessmen. Guidance: 1. Business industry has sponsored various guidance materials for science students. 2. They have underwritten the cost of testing programs, and have sponsored special plant tours and assemblies to motivate students to take science. Curriculum Suggestions: 1. They stress the importance of a fundamental and general education and do not want over-specialization. 2. Industry has accepted the cooperative educational plan as an alternate for training scientists and engineers. 3. More needs to be done in curriculum development for technicians. Gifted Students: They have specifically offered for this group summer employment in laboratories, special testing, seminars, and course work in college.

In summary, the data indicates that business-industry and education have worked well together to improve science education in this country.

Microfilm $2.05; Xerox $7.20. 155 pages.

RELATIONSHIP OF CERTAIN FARM AND SOCIO-ECONOMIC FACTORS TO THE FARMING STATUS OF 116 FORMER STUDENTS OF VOCATIONAL AGRICULTURE IN THREE COUNTIES OF VIRGINIA

(L. C. Card No. Mic 59-2725)

Roy Wendell Watson, Ph.D.
The Ohio State University, 1953

The purpose of the dissertation is to determine to what extent and by what means former high school students of vocational agriculture of Amelia, Cumberland, and Dinwiddie counties of Virginia have succeeded in advancing in farming status; at what rates they have advanced; and the relative importance of the factors affecting their advancement in farming status.

The need for such a study lies in the increasing number of Negro students leaving high school agriculture with a low economic and farming status in the prospects of this situation continuing to grow, and in the apparent difficulties which have been encountered by most of the former students in advancing in farming.

The study includes an examination of 116 former high school agricultural students in three counties who left high school in the period from 1929 to 1949 and who occupied the allowance- and enterprise-owner farming statuses when they left high school and had attained the farm laborer-allowance, sharecropper-enterprise owner, renter-partner and owner-part owner status groups by 1950.

Amelia, Cumberland, and Dinwiddie counties were chosen because they possessed the older established high school departments of vocational agriculture for Negroes representing the principal types of farming in Virginia and covering a wide range of farm tenancy of the state.

The 1950 farming statuses of the former pupils or students of vocational agriculture leaving high school in the period 1929 to 1949 were secured from the follow-up records of the teachers of vocational agriculture of the three counties studied. From these records the former students were found to occupy eight farming statuses in 1950. These eight statuses were combined into four status groups for convenience in tabulating and analyzing the data.

The 116 former students of high school agriculture represented all the students who left the three departments of vocational agriculture between 1929 and 1949 and were farming in 1950. These students had been enrolled in vocational agriculture in high school one or more years and had been out of high school one or more years prior to June 1, 1950.

The selected factors used in the study of relationships were rated by a competent jury of five men on the basis of whether they were above average, average, or below average in respect to their bearing upon farming status. Only the factors that received the same rating by a majority of jury members were included or excluded from the study. The factors were grouped in three major areas: those related to the high schools attended by the former students, those related to the student's homes and home farms at the time they left high school, and those related to the former students after leaving high school.

It was found that the larger percentage of former students who advanced to the higher farming statuses between leaving high school and 1950 had greater high school tenure than the students who occupied the lower farming statuses. Likewise, a larger percentage of former students of high school agriculture who had attained higher statuses in farming were those who left high school with higher standings from the point of view of farming status, scholastic achievements, efficiency, and diversity of supervised farming programs. A larger percentage of the higher established groups had also advanced from the allowance to the enterprise owner status of farming in less time than the lower established groups while they were enrolled in high school agriculture.

A relatively high correlation of the bearing of factors of students' homes and home farms upon their farming status after leaving high school was indicated. The largest percentage of former students of the highest established group (owner-part owner) had the largest percentage of fathers established as full farm owner operators.

The efficiency of farm production and the efficiency of the use of labor were generally greatest on home farms

of the more advanced groups. Evidence did not indicate, however, that the size of the farming program on the home farm of the former students was an important influence upon the farming status attained by the groups after leaving high school. Home farms with superior soil building programs, more appropriate farm buildings, and more modern home conveniences and facilities were usually home farms of former students who had advanced higher in farming status.

Opportunities for advancement in farming appeared greatest on home farms of former students with less competition from brothers. The two higher established groups (owner-part owner and renter-partner) had fewer brothers but a larger number of sisters than the lower sharecropper-enterprise owner and farm laborer-allowance groups. Both brothers and sisters of the two higher established groups were older and had lived away from home longer than the brothers and sisters of the two lower established groups.

The background of the former students' fathers appeared to have considerable influence upon the advancement of the former students in farming. The two higher established groups had older fathers who had received more formal training in school. Fathers of the two higher status groups had also been engaged in farming longer and had attained higher statuses in farming.

Some factors were apparently more important than others in influencing the rate at which the former students advanced in farming status after leaving high school. For example, the efficiency of the former students' supervised farming programs and the efficiency of the farming programs on their home farms appeared to have greater effect upon the advancement of the former students in farming than size of farming programs. Each succeeding higher group, however, grew a larger number of acres of crops at the time of leaving high school.

The status to which the former students had advanced in farming at the time of leaving high school appeared to have some effect upon the rate the young men advanced in farming after leaving high school. Sixty-nine per cent of the former students who were owners and part owners in 1950, and 70 per cent who were renters and partners, left high school in the enterprise-owner farming status. Sixty-two per cent of the sharecroppers and enterprise owners left high school as enterprise owners, but none of the farm laborers and allowancers left high school as enterprise owners. Obviously, 31 per cent of the owners and part owners and 30 per cent of the renters and partners left high school as allowancers; and 38 per cent of the sharecroppers and enterprise owners and 100 per cent of the farm laborers and allowancers left high school as allowancers.

A portion of the final area of this study was a sort of test of the influence of the high school, the home, and home farm on the advancement the former students made in farming after leaving high school and establishing themselves in farming. Each succeeding higher group conducted larger farming programs after becoming established in farming. This pattern did not exist in relation to advancement in farming and size of farming programs conducted by the former students at the time of leaving high school. This pattern also failed to exist in relation to advancement of the former students in farming and the size of farming programs conducted on their home farms at the time of leaving high school. In regard to efficiency, the higher established groups conducted more efficient farming programs after becoming established in farming. The higher established groups also conducted more efficient supervised farming programs at the time of leaving high school and were from home farms that had more efficient farming programs at the time they left high school.

More diverse farm practices, years of farm experience and better farm practices seemed to favor advancement in farming. The former students who made the greatest advancement in farming between leaving high school and 1950 carried a larger number of different farm enterprises, different supplementary farm practices, and higher rating soil improvement practices. The highest group (owner-part owner) also had the largest number of years of farming experience.

The greater proportion of the higher groups (owner-part owner and renter-partner) was marred in 1950. On the other hand, the greater proportion of the lower groups (sharecropper-enterprise owner and farm laborer-allowance) was unmarried in 1950.

Among the most significant conditions revealed by this study were the following: (1) the former pupils who made less progress in advancing in farming status were generally those who made a poor showing while enrolled in high school agriculture; (2) slow advancement was also observed where the largest proportion of home farms had poor yielding farming programs; (3) relatively less advancement was indicated where former students had experienced farming with parents who were established below full farm ownership; (4) home facilities and soil improvement practices were generally poor on home farms of the lower established groups.

To counteract the four conditions which appear to retard advancement in farming, the following measures are advisable: (1) continued efforts to develop supervised farming programs which will facilitate advancement in farming status; (2) specific effort with the development of farming programs with adult farmer groups; (3) definite attention to the discovery of opportunities for placement of those in farming whose home farms do not provide such opportunities; and (4) recognition of possible opportunities to help improve physical conditions of farm homes and the development of more intensive and extensive programs of vocational education in agriculture for high school, young and adult farmer groups.

Microfilm $2.40; Xerox $8.40. 182 pages.

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EDUCATION, ADMINISTRATION

A STUDY TO DETERMINE AN ADEQUATE INTERMEDIATE UNIT OR UNITS FOR A DISTINCT GEOGRAPHICAL AREA IN NEBRASKA

(L. C. Card No. Mic 59-1880)

Elizabeth Anne Bull Ellison, Ed.D.
The University of Nebraska Teachers College, 1959

Advisers: Merle A. Stoneman, Ph.D.
Rosalie W. Farley, Ph.D.

The purpose of this study was threefold: (1) to determine a need for an intermediate unit (units) in the designated geographical area comprising the four Nebraska counties of Dodge, Lancaster, Saunders and Seward; (2) to determine an adequate intermediate unit (units) for the designated area; and (3) to recommend a program of services which the intermediate unit (units) should provide in order to supplement the offerings of the local school districts.

The steps undertaken in the progress of this study were: (1) a review of the literature; (2) a compilation and analysis of data gathered from school administrators, state and national departments of education, and leaders in the field of rural education; and (3) the development of recommendations based upon conclusions drawn from the study. Four Nebraska counties were selected for an intensive study to determine the nature of administrative organization needed to provide a comprehensive educational program to local school districts.

Conclusions

The findings of the study indicated a definite need for an intermediate level of educational administration in the four counties investigated which would provide supplementary educational services to local school districts. In the geographical area studied (the counties of Dodge, Lancaster, Saunders and Seward) the following conclusions were drawn:

1. The existing local school districts should be reorganized into larger administrative units.
2. The existing intermediate units based upon county lines do not meet the established standards of adequacy. Some of the services essential to a comprehensive educational program are not being offered consistently to students in local school districts from any administrative level.
3. The geographical area studied could be satisfactorily reorganized into two intermediate units which could provide the needed educational services.
4. Since it is the function of the intermediate unit to provide educational services not feasible at the local district level (such as supervision of instruction, curriculum development, special education and health services), professional personnel should be provided in the two proposed unit offices capable of servicing all of the local districts as needed.
5. The establishment of an intermediate unit board of education would provide for development of educational policies by the elected representatives of the people directly served.

Microfilm $3.50; Xerox $11.80. 270 pages.

PERCEIVED COMPETENCIES OF SCHOOL SUPERVISORS

(L. C. Card No. Mic 59-2807)

Lucille Estelle Caster Foster, Ed.D.
Stanford University, 1959

The study is primarily concerned with the identification and analysis of teachers' and supervisors' perceptions of what constitutes "effective" supervisory behavior. In addition, it is concerned with the development of an operational statement of the critical competencies needed by elementary general curriculum supervisors to fulfill the function of helping teachers improve the total conditions that surround learning.

The study attempted to answer some related questions focused around the critical competencies of the supervisor: (1) Is there a significant difference in the perceptions of effective behaviors by each respondent group? (2) What relationships exist between the perceptions of effective behaviors and the educational background of the respondent? (3) What relationships exist between the perceptions of effective behaviors and the amount of contact the respondent has had with supervisors? (4) What relationships exist between the perceptions of effective behaviors and the respondent's orientation toward children as inferred from the Minnesota Teacher Attitude Inventory?

The Critical Incident Technique was the research method used. The Minnesota Teacher Attitude Inventory scale was incorporated into the design to determine in part the frame of reference of the respondents.

The respondents in the study were forty elementary supervisors and fifty elementary teachers, each of whom was personally interviewed by the researcher. Raw data of two types were gathered and recorded, descriptive information on the respondent and descriptions of behavior. From the 90 interviews, 363 incidents were obtained, 170 from supervisors, and 193 from teachers. Four major areas of activity were derived from the behaviors as constituting the critical areas of the work of the elementary general curriculum supervisor:

I. Providing Opportunities for Acquiring Inservice Growth
II. Curriculum Materials
III. Interpersonal Relations
IV. Working with Parents and Parent Groups

Further analysis of the behaviors through the process known as category formulation inductively developed statements of twenty-four critical competencies of the elementary general curriculum supervisor.

The following conclusions are offered:

1. Analysis of the data seems to indicate that there is considerable agreement between teachers and supervisors, in this sample, as to their perceptions of critical competencies of the elementary general curriculum supervisor.

2. The statement of critical competencies as perceived by the respondents seems to verify some of the behaviors theoretically proposed as successful by educators concerned with supervision techniques.

3. The background and experiential variables employed in this study for describing and comparing the reports of teachers and supervisors in this sample did not prove to be of value in differentiating various patterns of perceptions of supervisory behavior.

4. An examination of the statements of the perceptions of critical competencies reported by both teacher and supervisor respondents gives evidence to support the idea that on-the-job training for teachers is needed and is considered an important function of the supervisor.

5. The study revealed specifically described "effective" behaviors of elementary general curriculum supervisors.

6. An analysis of the distribution of critical behaviors derived from the perceptions of the respondents revealed little difference in the distribution by areas with the exception of the area of interpersonal relations where the teachers appeared more concerned than the supervisors.

In developing and clarifying a complete statement of the success criteria for the elementary supervisor, the perceptions of all who are involved should be considered. Thus, additional studies involving the perceptions of other school personnel and members of the community should be undertaken. There needs to be periodic, if not continuous examination of the supervisory role, and in all cases, the information gained should be made available to the members of the teaching profession.

Microfilm $2.15; Xerox $7.60. 161 pages.

A STUDY OF THE SENIOR HIGH SCHOOL PRINCIPAL IN TEXAS, 1957-1958

(L. C. Card No. Mic 59-2619)

James Henry Goettee, Ed.D.
University of Houston, 1959

Purpose of the Study. The purpose of this study was to gather and provide a tabulated record of certain general, personal, and professional information concerning the Texas public senior high school principal for the 1957-1958 school year; and in the light of these findings, to draw conclusions to the following pertinent questions regarding the Texas senior high school principal:

1. What is the status of the public senior high school in which the Texas senior high school principal serves?
2. Does the Texas senior high school principal have a favorable personal background for the principalship?
3. Does the academic background and professional preparation of the Texas senior high school principal provide a good educational base for the principalship?
4. What is the experience and tenure status of the Texas senior high school principal?
5. How does the Texas senior high school principal allocate his time?
6. What is the principal's role in the Texas senior high school?
7. Should the economic status of the Texas senior high school principal be improved?

Sources of Data. Most of the data used in this report were obtained by means of a questionnaire sent, under the direction of the College of Education, University of Houston, to 1,075 senior high school principals listed in the Public School Directory, 1957-1958, published by the Research Division, Texas Education Agency. Of these senior high school principals, 53.6 per cent responded.

Available literature in the form of books, periodicals, theses, and bulletins was used to prvide background material. These materials constituted the basis for comparisons made in the respective areas of the study.

Findings and Conclusions. This study revealed numerous findings relative to the senior high school principal in Texas for the 1957-1958 school year; following each concluding statement, supporting data are presented:

1. The public senior high schools in which the senior high school principals of Texas work do not meet the educational needs of all youth.
   a. The senior high schools of Texas were located primarily in incorporated cities; practically all the Texas senior high schools were affiliated with the Texas Education Agency, and were the academic type.
   b. Although most of the Texas senior high schools were in session 175 to 177 days per year, not all of them were housed in separate buildings from the other grade levels of the school system.
   c. Of all the Texas senior high schools, 80.3 per cent had five hundred or less pupils enrolled.
   d. Of all the senior high schools in Texas, 45.3 per cent had ten or less faculty members; 78.1 per cent, thirty or less; and only .2 per cent one hundred or more.
   e. Approximately seven-eights, 86.4 per cent, of the Texas senior high schools were of the academic type; 78 per cent offered primarily the college preparatory curriculum.
2. The Texas senior high school principal has a favorable personal background for the principalship.
   a. The Texas senior high school principal was a male, born and reared in some rural area of Texas. His father was engaged in agriculture and his mother was a housewife.
   b. The median age of the Texas senior high school principal was 42.2 years, and he was a married man with children.
   c. The Texas State Teachers Association, the Texas Association of Secondary School Principals, the National Association of Secondary School Principals, and the National Education Association were the principal professional organizations to which the Texas senior high school principal belonged.
   d. The Texas Outlook and the Bulletin of the National Association of Secondary School Principals were the professional magazines the Texas senior high school principal read most

frequently; and the Reader's Digest and Life headed the list of non-professional magazines read by him.

3. The academic background and professional preparation of the Texas senior high school principal provide a good educational base for the principalship.
   a. The Texas senior high school principal had graduated from a public secondary school; had earned bachelor's and master's degrees from a Texas college or university; and had done some graduate study beyond the master's degree.
   b. The senior high school principal of Texas had earned the professional principal's certificate. Before being made a principal, he had taken courses in methods of teaching, educational psychology, general administration, and tests and measurements.
   c. Almost one-half of the Texas senior high school principals had earned advanced college credit during the past three years.
4. The experience and tenure of the Texas senior high school principal provide an adequate professional experience background for the principalship.
   a. The Texas senior high school principals included in this study reported educational experiences as follows: 92.5 per cent, classroom teacher; 32.6 per cent, elementary school principal; 19.7 per cent, junior high school principal; and 95.9 per cent, senior high school principal.
   b. More than 40 per cent of the principals had gained teaching experience in the district before becoming principal, and 50 per cent had served five years or more in his present assignment.
   c. Of the Texas senior high school principals, 41.8 per cent had been classroom teachers just prior to being promoted to the principalship.
   d. The Texas senior high school principal had accepted his first assignment as principal at 28.4 years of age.
5. The Texas senior high school principal allocates his time to meet the needs of his school and community.
   a. The principal maintained regular office hours, and his work day was nine and three-tenths hours.
   b. Of the school day, the principal spent 43.4 per cent of the time on administrative duties; 14.1 per cent, improvement and supervision of instruction; 13.9 per cent, pupil personnel administration; 12.1 per cent, extra-curricular activities; and 9.6 per cent, community relations.
6. Professional leadership is provided by the Texas senior high school principal.
   a. The principal had a 48.4 per cent chance that the school board and superintendent believed he was the responsible head of the school with authority to plan and carry out a school program.
   b. Of the Texas senior high school principals, 49.6 per cent had their administrative duties defined by mutual agreement with the superintendent, and one out of three principals had his duties defined by the rules and regulation of the board of education.
7. The economic status of the Texas senior high school principal should be improved.
   a. The Texas senior high school principal worked 9.83 months, and received a $6,303.00 annual salary.
   b. One-third of the Texas senior high school principals preferred to be employed ten months per year, eleven months, and twelve months, respectively.
   c. Of the Texas senior high school principals, 55.5 per cent had been forced to drop plans for personal and professional improvement.

Microfilm $5.85; Xerox $20.40. 458 pages.

CENTRAL OPERATIONAL SERVICE SPACES FOR UNIFIED SCHOOL DISTRICTS

(L. C. Card No. Mic 59-2936)

Leonard Anthony Grandy, Ed.D.
University of Southern California, 1959

Chairman: Professor LaFranchi

The purposes of the study were to (1) analyze operational services and spaces provided in unified school district administrative units and (2) determine criteria for planning central operational service spaces.

Data for the study were secured from a review of the literature, returns from a survey distributed to fifty-two superintendents of unified school districts, and an intensive study of central operational service facilities of ten selected California unified school districts.

Findings. (1) The following principles of planning were utilized to various degrees: safety, adaptability to school organization, efficiency, flexibility, adaptability and expansibility, adaptability to function, beauty, and economy. (2) Most districts provided the following shop service facilities: carpentry shop, painting shop, metal and welding shop, electrical shop, plumbing shop, locksmith shop, gardener's shop, garages, and warehouse. (3) Most desirable site features included a minimum of three acres including one parking space per employee, manufacturing or commercial zoning, the geographic center of district if possible, location away from operating schools and combined with the central administrative office site.

Conclusions. (1) The related literature provided little guidance for planning central operational service facilities. (2) There are certain criteria fundamental to both planning the interior spaces of a building and developing a site which when applied will help achieve successful planning. (3) There is a need for comprehensive planning in order to give the central operational service facilities consideration commensurate with the importance of the facilities and the contribution they make to the total educational program.

Recommendations. (1) The criteria developed in the study should be used in planning central operational service facilities for unified school districts with enrollments

between 3,000 and 25,500. (2) The following principles of planning should be applied to both building planning and site development: safety, adaptability to school organization, efficiency, flexibility, adaptability, expansibility, adaptability to function, beauty, economy, and employee participation. (3) Central operational service sites should contain a minimum of three acres, to which should be added .14 acres for every 1,000 pupils. The topography should be relatively flat with good drainage. Frontage on two streets and two accesses are very essential. The site should be located in the geographic center of the district provided such location is near the commercial center of the community. Zoning should be manufacturing or commercial. It is necessary to provide one parking space for every employee. (4) The following operational service facilities should be provided for all unified school districts within the range of this study; smaller districts should combine several of these services into multipurpose general shops: (a) carpentry shop, (b) painting shop, (c) metal and welding shop, (d) electrical and audio-visual shop, (e) plumbing and heating shop, (f) locksmith shop, (g) gardener's shop, (h) business machines shop, (i) offices, including toilets, shower, and lockers, (j) warehouse, including space for research and development in large districts, (k) transportation facilities, including space for office, repair, stalls, and storage and repair of all vehicles owned by the district. (5) Space computations for central operational service facilities should be made for each facility, using formulae provided in the study. Generally, a unified school district of 3,000 pupils should provide 13,000 square feet plus an allowance for transportation facilities. For every additional 1,000 pupils, but not to exceed 25,500 pupils, an additional 2,000 square feet is required plus an allowance for transportation facilities. (6) Relationships among the various facilities as well as function, equipment, and building features should be planned according to the criteria presented in the study. (7) There is a need for the revision of Chapter 19, Division 3, of the Education Code to include financing for the spaces recommended in the study.

Microfilm $3.85; Xerox $13.00. 300 pages.

A STUDY OF THE ORGANIZATION AND ADMINISTRATION OF GUIDANCE SERVICES IN THE ELEMENTARY SCHOOLS

(L. C. Card No. Mic 59-2938)

Don Edward Halverson, Ed.D.
University of Southern California, 1959

Chairman: Professor Emery Stoops

The purpose of this study was to investigate, describe, and evaluate the organization and administration of guidance services in elementary schools and to make recommendations based on the findings.

A postal card survey was conducted of all elementary school districts of over 900 average daily attendance in Los Angeles County. These districts were divided into three groups based on pupil enrollment figures: Group A, 901-3,000 pupils; Group B, 3,001-5,000 pupils; Group C, 5,001-15,000 pupils.

A set of evaluative criteria was developed by a survey of the literature. Refinements were made by a council of twelve specialists selected for their guidance abilities and backgrounds. These specialists were superintendents, assistant superintendents of instruction, directors of curriculum, and school psychologists.

A stratified sample of the survey districts (27 per cent of the total) was selected. The persons directly responsible for the organization and administration of guidance services in the selected districts were personally interviewed and the districts' services evaluated on the basis of the criteria.

Findings. (1) There was no general organization of guidance services peculiar to all or even the majority of districts. (2) Most school districts did not have adequate clerical assistance, sufficient guidance personnel, or satisfactory facilities. (3) Most districts had adequate record systems and guidance materials and supplies. (4) Medium-size school districts were particularly remiss in conducting research or evaluation studies on a general basis. (5) The majority of guidance personnel had adequate general education backgrounds, personal qualifications, and training. (6) Very few districts actually utilized guidance committees at the local school or district level. (7) Guidance directors in the smaller districts were generally school psychologists who were directly responsible to the superintendent of schools and, in the larger districts, were general guidance directors directly responsible to an assistant superintendent for health or curricular areas as well as guidance.

Conclusions. (1) General principles of good organization and administration of guidance services are being utilized in almost all elementary school districts. (2) Guidance committees are not generally utilized on either the district or local school level, especially in the smaller districts, although they are highly recommended in guidance literature and by the districts in which are employed. (3) Materials provided for guidance services are generally adequate; however, the total space assigned to the services is inadequate, even though the availability of private conference rooms is on the increase. (4) The greatest single need of school districts in the guidance area is increased personnel including both professional and clerical workers. (5) Guidance staff members are generally well trained and of a high caliber. (6) School districts of all sizes generally have a definite program for the collection of pupil information but do not utilize this information to carry on adequate research and evaluation studies.

Recommendations. (1) Districts should evaluate carefully the total space assigned to the guidance services and verify that it is adequate and includes a private conference room. (2) Clerical services should be increased so that the lack thereof does not hamper the proper functioning of the guidance program. (3) More care should be given by administrators and guidance personnel to the in-service training of teachers especially in the areas of child growth and development and in the development of materials useful in guidance units. (4) Much more research and evaluation should be conducted by districts and should include teacher methods as well as community surveys, pupil enrollment, and pupil grading studies. (5) Elementary school districts should re-evaluate their counselor-pupil ratios and strive to achieve more desirable ones. (6) More districts should investigate the desirability of guidance committees on the local school and district level.

Microfilm $5.20; Xerox $18.40. 406 pages.

CENTRAL OFFICE SPACES FOR UNIFIED SCHOOL DISTRICTS

(L. C. Card No. Mic 59-2612)

Heber Holly Holloway, Ed.D.
University of Southern California, 1959

Chairman: Professor E. H. LaFranchi

The purpose of this study was to analyze present central administrative offices and service spaces and to establish criteria for planning such facilities. Primary concern was focused on the amount of building space needed to perform each function.

The study was limited to unified school districts in California having an enrollment on October 31, 1957, of 1,501 to 25,500 students. Spaces for operational services such as warehousing and maintenance shops were not included in this study, but have been covered in a similar dissertation at the University of Southern California. A survey questionnaire was sent to each district, and an intensive study was made of ten district recommended by the State Department of Education as having excellent central facilities. In addition to factual data, recommendations were secured from district staff members concerning the adequacy of their facilities.

Findings. (1) Sites for central administrative offices varied from one to nine acres in size. They were located near the business district, the community center, the population center, and the geographic center and generally were provided with two access roads. (2) Central office facilities in 80 per cent of the districts with an enrollment of 4,501 to 25,500 were located on a site separate from an operating school. (3) Floor plans of the facilities studied showed an attempt to group like and related offices together. (4) The superintendent's office was located close to the board room and reception lobby in seven of the ten units. (5) Private offices were provided for assistant superintendents, business managers, curriculum directors, personnel directors, special services director, and some minor executives. (6) Other facilities included workshops, libraries, audio-visual rooms, vaults, and employee lounges.

Conclusions. (1) District staff organization and the scope of auxiliary services provided will influence the need for central office and service spaces. (2) Where noise or other interference is not a problem, large, well-planned offices forming a secretarial pool can be operated efficiently and at a saving in building costs and space as compared with separate private offices. (3) Either too much storage space or too little is expensive. (4) The use of executive offices as small conference rooms provides greater space utilization and at less cost than separate conference rooms. (5) An efficient central plant will promote educational efficiency of the district.

Recommendations. (1) The following formulas for space allocation were developed: (a) Site—two acres for the first 5,000 of ultimate enrollment or fraction thereof, plus one-half acre for each additional 5,000 enrollment or fraction thereof. (b) Parking spaces—ten per 1,000 for the first 5,000 enrollment, plus five spaces per 1,000 for the next 10,000 of enrollment, plus two spaces per 1,000 of ultimate enrollment above 15,000. (c) Total square footage in building—space for basic unit of board meeting room and superintendent's suite, plus space for any unusual service areas such as child care center offices, plus a minimum of one square foot per unit of enrollment. (d) Minimum space allotments for all individual offices and service spaces were developed, but cannot be included in this summary due to lack of space. (2) The number and kinds of offices needed should be determined and then arranged in the floor plan to group similar and related functions together in an effort to fit the work into the shortest possible route. (3) Movable interior partitions should be used where feasible with inflexible units such as vaults, stairways, and toilets at the end of buildings or in places that will create the least hindrance to future change.

Microfilm $3.40; Xerox $11.62. 262 pages.

A STUDY OF CHANGES IN STUDENTS AS A RESULT OF INVOLVEMENT IN COMMUNITY DEVELOPMENT PROJECTS

(L. C. Card No. Mic 58-5900)

Arley Levern Howsden, Ed.D.
The University of Nebraska Teachers College, 1958

Adviser: Walter K. Beggs, Ph.D.

Purpose and Procedure for this Study

The purpose of this experiment was to provide experiences beyond those usually offered to a senior modern problems class and to analyze changes in these students in regard to academic achievement, leadership status, attitudes, and assessment of community needs. This was to determine whether these students could be offered these additional experiences and still keep pace in regular academic achievement and social development with the other students who did not have these experiences.

The students in the experimental class were matched as a group with two control groups with regard to intelligence quotients, accumulated grade averages, number of activities participated in, and number of offices held.

Several instruments were administered at the beginning of the study and at the end of the study. Analysis of covariance and Chi-square were used to determine the significance of the change as measured by these instruments.

The students in the experimental group were encouraged to become members of community development committees. These committees had been organized as a part of the Nebraska Community Education Project, and they met to study the needs of the community and to attempt to find ways to meet these needs. Five such committees were active in York: recreation, appearance, economic, culture, and education. The students in the experimental class were also asked to visit regularly meetings of governmental agencies in the community. Seventeen resource persons were utilized during the regular class periods by the experimental group.

Results of the Study

The students in the experimental group had experiences in real-life community problem solving situations. Eleven of the twenty-three students in the experimental group were involved as members of community development committees, and these students rated this experience as the most

beneficial activity of the class. Many people in the community made favorable comments concerning the study.

The experimental group was able to have these additional experiences without showing any loss in academic achievement or social development when compared with the control groups. No significant change was found among the experimental group and the control groups on the California Achievement Test, Contemporary Problems Test, Attitude Questionnaire, and Friendship Rating Scale. The experimental group did show more growth on the Friendship Rating Scale than the control groups, but it was not significant statistically. The experimental group showed a significant gain on the Principles of American Citizenship Test. At the end of the study, the experimental group was in closer agreement with the findings of the community development committees in regard to the needs of the community than were the control groups.

Implications for Further Study

In order to secure the support of everyone involved, much time and effort is necessary before a teaching experiment which deviates from the accepted traditional pattern is inaugurated.

The schools have many opportunities to offer students experiences in the democratic solution of real community problems.

Students are able to make real contributions to the solution of community problems.

Many available resources in the communities are not being utilized in the school program.

Follow-up studies should be made to determine whether students given experiences solving real community problems contribute more to their communities as adults than the students who have not had these experiences.

A study should be made to evaluate this type of teaching experience in terms of teacher growth.

This type of teaching can do much to improve rapport between young people and adults in a community.

Future studies should be less concerned with measuring traditional academic growth and more concerned with evaluating the student's ability to solve community problems in a democratic manner.

Microfilm $3.60; Xerox $12.20. 278 pages.

RECOMMENDATIONS FOR THE ADMINISTRATION OF THE SCHOOLS OF GUAM IN LIGHT OF THE ISLAND CULTURE

(L. C. Card No. Mic 59-1758)

Robert G. Johnson, Ed.D.
The Florida State University, 1959

The purpose of this study was to make recommendations for the schools of Guam in light of the island's culture.

From 1955 until 1957, the author was a consultant for the elementary schools of Guam. During that period interviews were held, observations made, official documents of the government of Guam examined, and general and cultural histories of Guam were read. The data gained from these sources were supplemented by the use of literature in anthropology and sociology.

Some of the more general aspects of the culture and geography of Guam were described. In addition present conditions of the island schools were discussed. In light of the information thus presented educational principles were applied to develop specific administrative recommendations.

A number of basic conditions were considered as important causes for recommendations to be made. First, textbooks from the United States assume many experiences not realized by the children of Guam. Second, the culture of Guam is in a state of flux. Third, the Guamanian people have had the added responsibilities of United States citizenship since 1951. Fourth, the population is bilingual. Fifth, there has been a historic lack of continuity of educational leadership in the schools. Sixth, the average college training level of local teachers is substandard by mainland standards; and seventh, there is a dual salary schedule in that recruited teachers are paid a 25% differential.

Some of the specific recommendations were made concerning general administration. The board of education should be elected by the registered voters of the island, except for two non voting members representing military interests; the five voting members should serve staggered six year terms. The board should assume authority with respect to school personnel, finance, and accounting procedures, which are now held by other governmental agencies and departments. Also, the board should be responsible for private and parochial school teacher certification in addition to the public schools.

Other recommendations considered teaching personnel. New recruited personnel should be required to attend orientation classes concerned with the culture and with school problems. With respect to pay, local and recruited teachers who have the same professional training should be compensated on the same salary schedule, without the addition of differentials. All teachers who resign during the school year should be compensated for the summer months on a pro rated basis. Concerning tenure, such laws should be uniform for local and recruited personnel. For recruited, as well as local teachers, an in-service education program should be organized with problems of acculturation receiving prominent attention. Teacher consultants in music, art, and physical education should be employed. Such resource people should derive much of their material from the local culture.

Recommendations were also made with respect to pupil personnel and the curriculum. Concerning school attendance, the school nearest the residence should be the one required for attendance whenever possible or practicable. As a means of evaluation, consideration should be given the development of a planned testing program. Connected with culture and language, a summer kindergarten should be developed to serve children the year before their entry into first grade, a plan of primary grouping should be considered for adoption, and educational personnel should become acquainted with the problems of bilingualism and biculturalism. Also, the language of the Guamanian people, Chamorro, should be adopted into the curriculum. To help extend the present school program, planned field trips should be instituted, and special materials, suitable for the local environment, should be introduced into the schools.

Microfilm $2.50; Xerox $8.60. 189 pages.

MERIT-RATING SALARY PLANS IN PUBLIC SCHOOL SYSTEMS OF THE UNITED STATES, 1955-56

(L. C. Card No. Mic 59-314)

Irvin Albert Karam, Ed.D.
Temple University, 1958

The major purpose of this study was to determine what types of merit-rating salary plans have been developed and are in operation in the public school systems in the United States.

Careful investigation disclosed sixty-nine public school districts which were actively using merit pay plans. Questionnaires yielded information relative to the development, installation, and administration of each plan. The plans were then classified and their particular features analyzed. A second questionnaire to the chief administrative officials asked for their opinions on the success of the plan, and what recommendations they would make for a school district contemplating the adoption of the merit feature to their salary schedule.

Findings

The principal findings of this study were:

1. Careful investigation revealed sixty-nine merit-rating salary plans in active use in the United States.
2. All sixty-nine plans could be divided into seven distinct types: (1) the Supermaximums, (2) the Accelerated Increment types, (3) the Bonus plans, (4) the Multiple-Track plans, (5) the Periodic Merit Evaluation type, (6) the Annual Outstanding Teacher Award, and (7) the Summer Merit Teacher Projects Program. Some districts combined several merit features into one plan.
3. The Net Current Expenditures per Pupil were above the national mean for 1956 in 87% of the plans.
4. Seventy-four per cent of the total districts had fewer than 250 teachers.
5. Exity-six per cent of the districts paid mean salaries above the national teachers' mean salary.
6. Of all plans analyzed, 93% have been developed since 1946.
7. The majority of plans did not contain formal written evaluation policies and procedures.
8. The majority of plans were developed as a result of school board pressure.
9. Though implied in many cases, Pupil Achievement was rarely used as an item in the evaluative criteria. Teaching Ability was the most frequently mentioned factor and received the heaviest weighting.
10. Teachers usually constituted a majority of the committee which developed the typical merit-pay plan.
11. The superintendent and building principal usually served as evaluators of teacher performance.
12. All plans provided that evidence of teacher performance be deposited in a cumulative record folder of some nature.

Conclusions

Within the limits of this study, the following conclusions seem to be valid:

1. There are very few teachers' salary schedules in existence today which relate salary to competence.
2. The fact that the majority of the merit-salary plans judged successful by the chief administrative officials using them were in use in districts with relatively high net current expenditures, seems to indicate a positive relationship between the amount of money spent and the success of the plan.
3. The majority of the merit-salary plans judged successful by the superintendents or supervising principals using them were in use in districts paying relatively high mean salaries for teachers. This provides some evidence for the point of view that there is a positive relationship between basic salaries paid to teachers and the success of a merit plan.
4. The fact that most of the existing merit salary plans have been originated in the past ten years probably indicates that the practice may be in the stage of initial growth.
5. Since most of the plans judged successful in the opinions of the chief administrative officials were developed by committees consisting of administrators, teachers, and school board representatives, a positive relationship is indicated between involvement of those directly concerned and the success of the plan.
6. Most merit-pay plans seem to have been developed as a result of the wishes of the school board.

Microfilm $3.35; Xerox $11.40. 257 pages.

CRITERIA FOR PLANNING THE ADMINISTRATIVE UNIT IN THE ELEMENTARY SCHOOL

(L. C. Card No. Mic 59-1848)

Curtis Hollie Kennedy, Ed.D.
University of Southern California, 1959

Chairman: Professor E. H. LaFranchi

The purpose of this study was (1) to analyze elementary school administrative space requirements and the facilities needed to provide adequate housing for elementary school administrative services and (2) to ascertain the most desirable features of such space provisions.

The problem involved the determination of (1) current planning and use of administrative spaces in selected elementary schools, (2) the services for which provision should be made, (3) the spaces and facilities necessary to house these services, and (4) planning procedures considered adequate and representative of the best contemporary thinking in schoolhouse planning. The study was carried out by means of (1) a résumé of related literature and research and (2) a series of structured interviews with concerned personnel in fifteen elementary schools in Southern California selected on the basis of recency of construction and recognized adequacy of design.

Findings. (1) The number of persons involved in the planning of elementary administrative units was limited in most schools studied. (2) It was considered most effective to locate the administrative unit in a relatively quiet area. (3) A single-story structure was favored over a multistoried structure in all cases. (4) Planning a combined waiting area for students, parents, and patrons was considered more effective than separate waiting areas. (5) Among special planned administrative areas, the teachers' workroom was considered most important. (6) Although most administrative units were planned with temperature controls which applied to the entire unit, separate controls for individual offices were considered the best practice.

(7) A public address system was not considered essential. (8) Services for which space provisions were made in general offices were reception, management, and clerical services. (9) Most schools considered a conference room a necessary part of the administrative unit. (10) A vision-testing area at least 22 feet in length was considered a necessary part of the health suite. (11) A majority of schools considered a combination teachers' workroom and lounge the most effective planning of teachers units. effectiveness of the teachers' lounge is increased when toilets do not open directly off the lounge area.

Conclusions. (1) The general planning of the administrative unit should be done with the participation of all persons most directly affected, i.e., teachers, parents, special service personnel, principal, nurse, and classified employees. (2) The services to be performed are the most important considerations in planning space provisions for modern elementary administrative units. (3) Assuming that the primary criterion in planning administrative spaces is the type of services to be provided, the prior formulation of basic educational and organizational policy is an essential initial step. (4) The interrelationship of administrative spaces is one of the basic determinants of the effectiveness of the total unit.

Recommendations. It is recommended that (1) the superintendent and his staff assume leadership and invite all concerned personnel to assist in planning the administrative unit; (2) a specific statement be made of the services for which space is to be provided in planning the administrative unit, in terms of district philosophy and established policy; and (3) planners of elementary administrative units give careful consideration to space requirements and interrelationships, taking into account the findings and recommendations of this investigation.

Microfilm $4.70; Xerox $15.80. 366 pages.

CHARACTERISTICS AND CURRICULUM EVALUATIONS OF BACHELOR AND MASTER OF MUSIC DEGREE GRADUATES FROM THE UNIVERSITY OF TEXAS (1948-1957)

(L. C. Card No. Mic 59-2489)

Louis Ude Kromminga, Ph.D.
The University of Texas, 1959

Supervisor: Professor James Walton Reynolds

Characteristics and evaluations were indicated by the following questions:

(1) What were the characteristics which were indicative of the typical (modal) and atypical (the extremes from the mode) student graduating with the Bachelor of Music degree and/or Master of Music degree from The University of Texas from 1948 to 1957?

(2) What were the vocational characteristics of the Bachelor of Music and/or Master of Music degree graduate from The University of Texas from 1948 to 1957?

(3) What evaluation was made of applied music study on a principal instrument by Bachelor of Music degree graduates, and evaluation of graduate study by Master of Music degree graduates, of those participants reporting on the questionnaire who received the Bachelor of Music degree and/or the Master of Music degree from The University of Texas from 1948 to 1957?

These questions were answered by information compiled from two sources: (1) information from the total population used in this study which was compiled directly from the transcripts in the individual file of each graduate, and (2) information received from a sampling of the total population who filled out and returned the completed questionnaire. This sampling included 45.5 per cent of the total number of Bachelor of Music degree graduates and 48.9 per cent of the total number of Master of Music degree graduates from The University of Texas from 1948 to 1957.

Three hundred thirty-two students graduated with the Bachelor of Music degree, 229 with the Master of Music degree, from The University of Texas (1948-1957). The Bachelor of Music degree graduates included 53 per cent transfer, and 47 per cent native. There were 67.7 per cent senior college and 32.3 per cent junior college transfers. Junior college transfers lost an average of 2.26 semesters, senior college transfers an average 1.60 semesters work on their applied music principal instrument at time of transfer to the University. Average number of semesters study lost by piano and organ students was 1.24; voice students, 1.23; string and harp students 1.21; brass students 1.13; woodwind students 0.65. There were 84.8 per cent of the total Bachelor of Music degree participants who believed the required applied music proficiency level at the University was as it should be, however, 66.6 per cent of the transfer students said their applied music proficiency level before transfer was lower than The University of Texas.

Participants who were non-Music Education majors found 26.8 per cent of the Bachelor of Music degree graduates, and 30.8 per cent of the Master of Music degree graduates teaching music education. There were 33.9 per cent of the Master of Music degree participants changed area of concentration from Bachelor to Master of Music degree. Largest group (60.5 per cent) changing area of concentration was Applied Music majors. There were 42.1 per cent changing to Music Education and 34.2 per cent to Music Theory. There were 47.4 per cent changing who wanted to qualify for another type of work, and 42.1 per cent felt a need for knowledge in another area of concentration.

One of every eight Bachelor of Music degree participants, and one of every four Master of Music degree participants who graduated from The University of Texas were teaching on the college level. There were 41.1 per cent of the Master of Music degree participants who either plan to work on a doctorate, have the degree in progress, or have already completed the degree. Of these participants, 65.2 per cent wanted their degree in music, 23.9 per cent in education, and 10.9 per cent undecided on area of concentration. Microfilm $2.65; Xerox $9.20. 201 pages.

AN EVALUATION OF THE SECONDARY-SCHOOL PROGRAM OF THE PUBLIC SCHOOL SYSTEM OF WARREN COUNTY, PENNSYLVANIA

(L. C. Card No. Mic 59-2894)

Everett Arthur Landin, Ed.D.
The Pennsylvania State University, 1959

The Problem

It was the purpose of this study to ascertain and evaluate the opinions of persons who are present or former students within the schools of Warren County and to examine those opinions as a means of estimating the total effectiveness of the school system. Each respondent was asked to indicate his personal evaluation of every curricular and co-curricular experience of his high school career in terms of the contribution which each experience had made toward proficiency in each of the abilities represented within the "Ten Imperative Needs of Youth" (as stated by the National Association of Secondary School Principals in Planning for American Youth, Washington, D. C., National Education Association, 1944).

The study was designed to test six hypotheses by means of the information which the respondents submitted:

1. The students within the Warren County high schools have received training in a sufficiently adequate variety of courses and activities for one to assume that they have acquired all of the essential skills and abilities.
2. The skills taught in any one course or activity lent proficiency in a number of the individual areas of the basic needs of youth.
3. Recent enlargement of high schools through consolidation has increased the total effectiveness of the high school program within young lives.
4. The extent and nature of the contribution made by various courses varied according to the activity and training which participation in a particular course included.
5. All basic needs of youth have been equally and well served.
6. Curricular change and school system re-organization have increased the total effectiveness of the school system of the county.

The Procedure

The questionnaire technique of learning opinions from a total of 1,537 persons was used in the study. Of these persons 1,312 were senior high school students, and 225 were out-of-school adults when they were surveyed. The process included these steps:

1. A questionnaire which registered the opinions of the respondents in terms of each high school course or activity and in relation to each of the ten imperative needs was developed. These opinions were expressed in one of three stages of effectiveness: no effect, slight effect, extensive effect.
2. All senior high school students were visited in the classroom situation, and school time was used for their evaluation.
3. Out-of-school adults received the questionnaire, instruction sheet, and personal (cover) letter from the writer. All were encouraged to respond by returning the questionnaire.
4. Raw data were tabulated in terms of two groups of respondents: students and out-of-school adults.
5. Raw data were next expressed as per cent of total possible effective ratings and plotted in specially designed Figures.
6. The written report was developed to evaluate the tabulated and illustrated materials.

Conclusions

The following conclusions were dominant:

1. Legally mandated courses acquired the highest student participation; the more difficult electives attracted the fewest students; and subject-oriented clubs were the more frequently selected co-curricular activity.
2. Respondents believed the total effectiveness of the high school program to be less than forty per cent as high as it could have been.
3. Students rated the effectiveness of the school program higher than did out-of-school adults.
4. Co-curricular activities were considered more effective than were curricular activities.
5. Skills related to earning money, becoming a better citizen, and speaking and thinking clearly were indicated to be those most effectively served.
6. Extensive and persistent curricular and organizational changes have preceded the higher effectiveness rating which younger respondents indicated during this study.

Microfilm $3.15; Xerox $10.80. 243 pages.

MUSIC SUPERVISION IN CALIFORNIA CITY SCHOOLS

(L. C. Card No. Mic 59-1851)

Joseph Warren Landon, Ed.D.
University of Southern California, 1959

Chairman: Professor Rush

The purpose of this study was to determine which activities were performed and emphasized by music supervisors in California city school districts of 5,000 A.D.A. and over. Information was obtained from the related literature, questionnaire check lists, and personal interviews concerning (1) the historical and current importance of music supervision in public schools, (2) the current status and operational role of music supervisors in California city schools, (3) the activities in which California music supervisors engage, (4) the emphasis currently placed on these supervisory activities, (5) the relative value or usefulness of these activities, and (6) problem areas and promising practices.

Participating California city school districts were represented by sixty-four music supervisors and fifty-seven administrators to whom the supervisors were responsible. In addition, fifty-nine widely recognized music education specialists representing twenty-eight states and each of the six divisions of the Music Educators National Conference participated in the investigation. Each respondent was asked to evaluate a total of 192 activities of music supervisors on a four-point rating scale. Music supervisors used this scale to indicate operational emphasis, while administrators and specialists rated the relative value of these items. Supplementary data were obtained concerning the personal and professional status of music supervisors, school district organization, and problem areas and promising practices. The basic statistical method for determining the significance of mean score differences was the critical ratio formula for uncorrelated means.

Findings. The investigation revealed that all but 28 of the 192 activities were performed by two thirds or more of the music supervisors in California city school districts. Supervisory practices were more diversified and cooperative in nature in larger school systems. Music supervisors emphasized, in rank order of importance, (1) resource-advisory activities, (2) curriculum development, (3) in-service education activities, (4) student activities in music, (5) evaluation, selection, and use of the materials of instruction, (6) personal and professional development, (7) personnel activities, (8) administrative activities, (9) research and evaluation, and (10) community leadership and public relations.

Activities concerned with resource assistance to teachers and administrators; cooperatively developed and flexible music curricula; specific aids to teachers including conferences, demonstrations, workshops, departmental meetings, assistance in selecting and using appropriate aids to instruction; and making plans for personal professional development were highly ranked by all respondents.

Although significant differences were found on 75 per cent of the 192 items, only 18.3 per cent of these involved activities which administrators and specialists recommended as deserving considerably higher supervisory emphasis. These included increased use of (1) teacher leadership, (2) teachers and resource persons in meetings and workshops, (3) central staff planning of curricula, (4) helps to teachers in planning and evaluation, (5) experimentation, (6) participation at district level in administrative meetings, budget building program, and teacher selection, (7) coordination of district music activities, (8) techniques of communication with school and community, and (9) participation in community music activities. Less emphasis was recommended on (1) informal visits to schools, (2) voluntary teacher attendance at workshops, (3) advisory services to the administrative staff, and (4) formal evaluation of secondary teachers.

Concerns were expressed relating to staff communications, lack of teacher contact, lack of time, "self-contained" classrooms, and curricular requirements.

Conclusions and Recommendations. This study suggests a need for standardization of title, responsibility, and staff relationships. The titles of director, coordinator, consultant, and resource teacher are recommended, consistent with assigned responsibilities. The position of music supervisor requires careful analysis relative to supervisory load and priority and emphasis on the types of activities performed. Additional attention should be given to improving group and cooperative techniques of supervision and in studying the music supervisor's role in the areas of administration, research and evaluation, personnel activities, and community leadership.

Microfilm $12.80; Xerox $45.80. 1016 pages.

THE DEVELOPMENT OF A SOURCE BOOK OF SUGGESTED COMPETENCIES AND ACTIVITIES FOR INTERNS IN SECONDARY SCHOOL ADMINISTRATION

(L. C. Card No. Mic 59-1917)

Jack Paul Laurence, Ed.D.
University of Maryland, 1958

Supervisor: Clarence A. Newell

A source book of suggested competencies and activities for Interns in secondary school administration was one of several doctoral studies undertaken to improve or evaluate the internship programs at universities in the Middle Atlantic Region of the United States. The purpose of the study reported here was to provide an instrument which would be of assistance in the planning of the internship experience.

A study of research concerned with the necessary competencies in educational administration, an analysis of professional literature in the field, and the evaluation of internship programs in educational administration was undertaken to provide a basis for the development of basic competencies necessary for successful school administration.

The basic competencies were presented to a jury composed of principals, supervisors, professors of school administration and educational directors who were requested to select those competencies which they believed were essential to the receiving of a professional preparation in principal internship. The suggestions of the jury led to the formation of the source book. The final list of competencies was submitted to Professors of Education at the University of Maryland for their evaluation and suggested revisions.

The source book has been developed as an aid in the technique of planning and devising a sound internship program. It is so arranged as to make possible the programming of a unique plan for every individual intern. The outlined duties of the intern constitute the essence of the source book. Nine areas of high school principal responsibility and the methods used by the intern in gaining proficiency in each of these areas are identified. Each area represents a group of similar or related tasks, and constitutes a section in the source book.

The source book deals with an important part of the prospective administrator's experience. It is an instrument which is organizational in nature and designed to extract valid experiences for the intern from organized materials which thus far have not been organized for the internship experience.

As a general conclusion, it may be said that the source book shows promise of becoming a useful device to be employed in the training of interns who plan to become high school principals. Because the source book is a tool

and not a body of dogma, it can accept refinement and revision without prejudicing its basic premises regarding the competencies and activities necessary for a secondary school administration internship.

Microfilm $2.65; Xerox $9.20. 202 pages.

A MERIT SALARY POLICY FOR A PUBLIC SCHOOL DISTRICT

(L. C. Card No. Mic 59-1939)

John Joseph McKenna, Jr., Ed.D.
New York University, 1959

Chairman: Professor R. Emerson Langfitt

The Problem

The problem was to identify principles of administration of merit salary policies and to formulate a workable merit policy for a public school district.

Procedure

Functional merit salary policies in nineteen school districts in New Jersey and in seventy school districts in other states were screened for common administrative principles. Selected merit plans in industry, colleges, and government were also investigated. Statements by professional writers in school administration and industrial personnel administration were reviewed to spotlight current trends in merit policy organization and philosophy.

Recommendations

A synthesis of common factors which would aid in the development of a functional merit salary policy would include certain basic principles. These principles would include the following:

1. The basic design and the mechanics of operation of the merit policy should be a joint enterprise of the board of education, the teaching staff, and the administration.
2. The professional evaluation should be based upon evidence gathered over a period of more than one year. This evidence should consist of supervisory ratings done annually by more than one rater, professional contributions of the teacher, comments by parents and co-workers, an annual self-rating, and evidences of professional advancement. Such a program requires the establishment and maintenance of an accurate teacher-personnel cumulative record.
3. The merit plan should provide for the following:
   a. A handbook that gives a clear explanation of the merit policy and lists the criteria of evaluation
   b. A conference plan for the annual ratings
   c. Teacher-rater discussion prior to filing a report
   d. A common philosophy for those officials designated as raters
   e. An opportunity to appeal an evaluation
   f. A salary schedule up to 100 per cent higher than the standard automatic salary guide which would also be maintained for those staff members not advanced to the merit schedule
   g. Annual evaluation of the merit plan itself.
4. The professional evaluation, based upon accumulated evidence, to be done by a committee of administrators and teachers at regularly established stages of a teacher's professional career.
5. The merit policy would be designed to recognize superior professional endeavor on the part of a member of the teaching staff through a plan of salary differentials and professional status recognized within the school system.

Guide for Development of a Merit Policy

There should be three phases of the merit policy. These are the preparative, developmental, and the evaluative phase. The preparative phase is where a joint board and teaching staff committee decides on the general philosophy of the merit policy. The developmental phase continues through the offices of a joint board and staff committee to actually structure the proposed policy incorporating the recommended administrative principles. This phase would result in the development of the basic plan, the evaluative criteria, the method of criteria identification, and the implementation of the plan.

The recommended plan calls for the establishment of three professional levels. These are instructor, teacher, and master. The salary ranges would be: Instructor $4000. - 8500; Teacher, $5200 - 10,450; Master, $7600 - 12,000.

Selection of personnel for the various levels would be at stated intervals by a committee of three teachers appointed by the teacher's association who would review the cumulative personnel records of all staff members eligible for consideration.

The final phase would be the establishment of a plan evaluative committee to study the merit policy in operation and to perform an annual evaluation. The merit policy should be maintained in a more efficient and harmonious status through the functioning of this evaluative group.

Microfilm $2.10; Xerox $7.40. 159 pages.

THE EMERGING EVENING COLLEGE: A STUDY OF FACULTY ORGANIZATION AND ACADEMIC CONTROL IN TEN EASTERN UNIVERSITY EVENING COLLEGES

(L. C. Card No. Mic 59-2862)

Ernest Edward McMahon, Ph.D.
Columbia University, 1959

The evening college is the division of the university created essentially to provide college-level education for adult part-time students. A development of the last half-century, the evening college today is common in institutions in large centers of population.

Unfortunately, the growth of evening colleges has not followed any recognizable pattern. It has been largely unplanned, and the result is a welter of differing statements of purpose, academic practices, institutional status, and faculty organization. The confusion has existed within institutions as well as among them to the end that the

evening college field is one of uneasiness and controversy.

This dissertation presents the results of a comparative study of the history, to 1958, of the evening colleges that have emerged in Boston College, Boston University, the University of Buffalo, Brooklyn College, Columbia University, the Johns Hopkins University, University of Rochester, Rutgers--The State University, Seton Hall University, and Syracuse University. It includes systematic case histories of each, the material for which has been gathered from published and unpublished sources and through interviews with administrators and faculty members on the several campuses. The focus has been placed on the related issues of purpose, standards, institutional status, and faculty arrangements.

Basic to the confusion mentioned above is the attempt to provide two types of programs and to serve two purposes simultaneously; namely, to offer both regular college courses of a credit nature for adults and also "adult education" services in all their broad connotation of informal activities, student or group orientation, and social action. For example, a common method of attempting to serve the two purposes has been the informal admission of "adult education" students to the credit classes without examination of their academic records and formal preparation; the resulting problem has been concern over standards.

Actually, the trend in the programs over the years, especially as reflected in the courses offered, has been toward an apparent and almost exclusive emphasis on the traditional, credit-bearing courses. This, indeed, might be expected because the successful growth of the evening college appears to have come from attendance by three main streams of students: the professional person--such as the school teacher--who sought organized courses for professional improvement; the preprofessional student who sought to complete entrance requirements for admission to graduate schools; and the adult student who sought a college degree. With such students turning to the university in increasing numbers, it is small wonder that the evening college responded with increasing numbers of regular college courses to meet the evident need.

A common charge against the evening college is the allegation of low academic standards. A major difficulty in resolving the validity of such a charge is the frequent division of academic authority between an evening college administration and one or more day faculties. Two of the universities have faced this situation by establishing legislative evening college faculties so that full academic responsibility for and jurisdiction over the educational program resides in one place. A third institution appears to be moving toward a similar organization.

It seems to the writer that the ultimate resolution of the confusion and misunderstanding which afflict the evening college will rest upon such an organization of the university evening division into a true college--with a faculty--so that the problems of purpose, standards, and institutional status may be studied and solved by a responsible and organized group of evening college teachers whose primary professional responsibility is the evening college.

Microfilm $6.55; Xerox $22.80. 516 pages.

STAFFING SCHOOLS FOR DESIRABLE SERVICES

(L. C. Card No. Mic 59-2342)

Howard Morris, Jr., Ed.D.
Temple University, 1959

Purposes of the Study

The purposes of this study were twofold:

1. To develop a process for making a list of desirable school services, for describing these services and listing in detail the school activities and appropriate staff for each.
2. To use this process to produce a document which lists desirable school services and describes each service, its activities and related staff needs in such ways that the document can be used by administrators to judge the completness and quality of a school system's services.

Scope of the Study

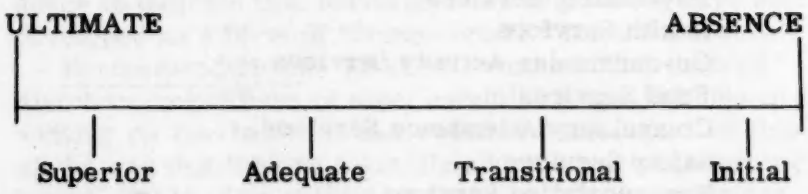
The process of developing this study involved the members of the Administrators' Seminar of the Philadelphia Area School Study Council, as well as other educators.

The material in the dissertation covered all services thought to be desirable for a school to offer people from late infancy to elderly adulthood. These were divided into Instructional Services, Co-ordinate Services and Services Allied with the Community.

General Procedure

The literature concerning each school service and its related staff needs was examined and the content outlined. These outlines were then presented to the Administrators' Seminar single, studied, discussed and revised again and again until all members agreed.

The material for each service was developed and arranged to show briefly the purposes of that school service, the school activities appropriate to that particular school service and the staff needed to offer that service. The activities and the staff needs of many of the school services were subdivided into four quality levels: Superior, Adequate, Transitional and Initial. These sub-divisions were arranged along a continuum:



Findings and Conclusions

Findings - The Process

1. The process used to produce this dissertation depended upon the validity of sharing and pooling the results of professional training and experience of school administrators as a research methodology.
2. The responsibilities assigned to the research associate were, in this process, indispensable to the discussions and the decisions of the group. It was in this way that decisions became guided by information based on authority rather than just experiential opinion.
3. As the process was carried on there was an apparent change in attitude among the seminar members toward favoring the broad responsibilities of school systems for offering services.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

Conclusions - The Process

1. School services desirable for a school system to offer and the staff needed to offer them can be listed and described by the process used here.

2. This project, by its method of operation, showed that the individual services of a school system can be described, defined and staffed without losing sight of the overall goals and organization of the school system.

3. This process depended upon the willingness of many people in key school positions to give a great deal of time. The month to month service of these administrators demonstrated their belief in the project and in the value of the method being used.

4. This process gave the study breadth because it used the experience and knowledge of a number of educators to supplement the findings of research as they agreed on the material about each school service.

5. This process, by its liberal portions of discussion connected with the agreement seeking steps, gave each service and its related staff need a perspective showing its relation to the whole school system.

6. The final phase of the process, namely the dividing of service offerings and needed staff into four quality levels, forced a minute examination of each element of each service in relation to its contribution to the offering of the service.

Findings - Concepts About School Services and Staffing

The following school services were found to be desirable:

Instructional Services
- Nursery School
- Kindergarten
- Elementary School
- Junior High School
- Senior High School
- Junior College
- Adult Education School

Co-ordinate Services
- Services for Children with Unusual Needs
- Guidance Services
- Psychological Services
- Psychiatric Services
- Health Services
- Co-curricular Activity Services
- Food Services
- Compulsory Attendance Services
- Safety Services
- Transportation Services
- In-Service Development of Teachers
- Camping Education
- Summer School Tutoring Classes
- Summer School Classes for Children of Migratory Workers
- Substitute Teacher Services
- Pupil Accounting, Census and Record Services
- School Business Management Services
- Clerical Services
- Custodial Services

Services Allied With the Community
- Use of School Facilities for Community Activities
- Educational Advisory Services to Adults
- Identification File Services
- Participation of Pupils in Community Events
- Invitations of Public to Outstanding School Cultural Activities
- Community Betterment Projects
- Evening and Summer Programs for Pupils and Adults
- Speakers Bureau Services
- School-Community Relations Services

Conclusions - Concepts About School Services and Staffing

1. The dissertation found that, when given time and material enough, school administrators can clearly define the activities appropriate to specific school services and directly relate to these activities the proper staff needs. Each of the nearly thirty services described illustrates this.

2. This project established that even though all school services go on at the same time and many overlap, the elements making them valuable can be separated and described. Usually the overall services of a school system are described but seldom are the individual services considered separately.

3. This investigation found that there is ample foundation in law as well as practice to show that it is essential to offer school services to people from late infancy through adulthood.

4. School systems have been primarily concerned with their service offerings for "typical" pupils from five to twenty years of age. Services for pupils with special needs and services for adults are beginning to be considered desirable.

5. The basic beliefs of the citizenry interpreted by its Board of Education are the most important determiners of what services are considered essential. There is ample evidence that the citizens of a school district can and will have those services they feel are important.

6. The essential service offering of a public school system is much broader than is usually thought.

Microfilm $2.15; Xerox $7.60. 163 pages.

THE ORGANIZATION AND ADMINISTRATION OF THE JUNIOR HIGH SCHOOL INSTRUCTIONAL PROGRAM

(L. C. Card No. Mic 59-2940)

Dave Schwartz, Ed.D.
University of Southern California, 1959

Chairman: Professor LaFranchi

The purpose of this study was to discover, analyze, and evaluate practices being utilized by administrators of three-year junior high schools in the organization and administration of instructional programs. The objective of the study was to determine which practices offered promise of success.

Questionnaires were sent to 572 principals in the nation. In reply, 390 usable returns were received, a 68 per cent return.

Findings. (1) The median length for certain phases of the daily schedule in junior high schools of the United States was: length of school day, 403 minutes; class periods, 50 minutes; lunch period, 40 minutes; nutrition period, 13 minutes; and homeroom period, 13 minutes

(2) No nutrition period was scheduled in 69 per cent of schools, the other 31 per cent scheduling nutrition periods. (3) A daily homeroom period was scheduled by 70 per cent of the schools. (4) Administrative purposes and guidance were reported by 72 per cent of respondents as the primary objective and function of homerooms. (5) An annual promotion procedure for pupils was reported by 79 per cent of schools. (6) Departmentalization of instruction was "extensive" in 60 per cent of schools. (7) The extent of block-time class scheduling was reported as "some" in 41 per cent of schools.

Conclusions. (1) There is a similarity in the administration of instructional programs in junior high schools throughout the nation. Few characteristics were peculiar to any one geographic area, differences being more common among size classifications. (2) Practices which are considered effective in some schools may be ineffective in others. (3) The optimum length for an effective school day and for an effective length of class period may vary according to local conditions. (4) The individual school situation must determine the type of lunch period scheduled. (5) Both departmentalization of instruction and block-time class programs contribute to effective teaching in the junior high school. (6) Homeroom programs would be strengthened through effective planning and leadership, and through the in-service training of homeroom teachers. (7) There is merit in the annual promotion of pupils, judging from the reported success and preponderance of use of the practice. (8) Comprehensive screening devices and exploratory courses are effective in determining pupil eligibility for algebra and foreign language classes. (9) There is a trend to expand junior high school guidance programs. (10) There is a general need to expand remedial instruction in the junior high school instructional program.

Recommendations. (1) The length of the school day should range between 390 and 419 minutes. (2) The length of class periods should be between 51 and 55 minutes, except when special local conditions require a shorter period. (3) In most instances, no more than two lunch periods should should be scheduled daily. Unless special local conditions require other lengths, each lunch period should be between 40 and 45 minutes. (4) An in-service training program should be provided to assist teachers in effective handling of the homeroom program. (5) The annual promotion of junior high school pupils should be adopted as a standard nationwide procedure. (6) The emphasis in junior high schools should be on intra-mural athletics. (7) Aside from their incorporation throughout all instruction, guidance and orientation should be fostered in the homeroom. (8) Both block-time class programs and departmentalization of instruction should be used in planning junior high school instructional programs. (9) Provisions for individual differences of pupils should be made by homogeneous grouping of pupils by ability, by remedial instructional needs, and by differentiated assignments within the classroom. (10) There should be an expansion of special classes offering remedial instruction in reading, mathematics, and English. (11) Greater use should be made of faculty curriculum committees in planning instructional programs.

Microfilm $6.75; Xerox $23.40. 531 pages.

LEAVE OF ABSENCE POLICIES FOR CERTIFICATED PERSONNEL IN CALIFORNIA SCHOOL DISTRICTS

(L. C. Card No. Mic 59-1863)

Noel MacHenry Shutt, Ed.D.
University of Southern California, 1959

Chairman: Professor Emery Stoops

The purpose of this study was to determine current leave practices of California school districts with 1,000 or more students in average daily attendance, and to determine the principles upon which leave-of-absence policies of California school boards should be based.

The recommendations and opinions of accepted authorities from the literature were sought. Current data were obtained through the use of two questionnaires which provided information concerning present leave-of-absence practices in California school districts and the recommendations of administrators in the field.

Conclusions. (1) There are many school districts in the state of California that do not at the present time have adequate leave-of-absence policies, and the policies in some are formed as expedients rather than as the result of thoughtful cooperative planning of administrators and teachers. (2) There is definite evidence that the larger the district, the more complete are the leave policies; however, there are no data to indicate that smaller districts could not develop or support policies similar to those of larger districts. (3) For the most part, there is great similarity between district practices and administrative recommendations. However, some discrepancies between theory and practice exist. (4) Although many leave policies were found to be specific in character, it is important that all policy statements provide for administrative discretion to permit adjustment of the policy to the particular situation and individual circumstance when needed. (5) Because of basic differences between industry and education with respect to objectives of the educational program and the unique requirements of the teaching situation, leave-of-absence policies for school districts are not comparable with those of business and industry. (6) There is no evidence to indicate that leave-of-absence policies have been developed as a form of "fringe benefit" for teachers.

Recommendations. (1) It is recommended that all districts, regardless of size, establish leave policies in writing on the basis of the criteria established in this study, and that they be formally adopted by the governing board. (2) In view of the fact that some of the practices reported by school districts are not in keeping with the state Education Code and many districts have few or no written policies, it is recommended that all districts provide for definite periodic review of policies to bring them within acceptable standards. (3) Administrative discretion should govern absences granted for very short and very extended periods of time. (4) Since the payment of regular salary minus the sum required to hire a substitute would result in no additional expense to the district, it is recommended that all districts establish written sabbatical leave policies for all certificated personnel incorporating this provision as a minimum. (5) Because of the increasing emphasis on research and advanced study, it is recommended that governing boards make greater effort to increase the salary benefits currently being granted to

teachers who are on sabbatical leave, and that greater use be made of their increased learnings upon their return to the district. (6) As an aid to the school district, and in encouragement of qualified personnel to continue study projects at the graduate level, it is recommended that school districts grant sabbatical leaves at full salary to selected individuals who are willing to devote their research study to problems which are of direct concern and benefit to the district. (7) The teaching profession should not look to business and industry for guidance in the formulation of leave-of-absence policies as they apply to teachers and administrators.

Microfilm $5.10; Xerox $17.00. 397 pages.

SPACE REQUIREMENTS OF THE HIGH SCHOOL ADMINISTRATIVE UNIT

(L. C. Card No. Mic 59-2943)

Harold Charles Tonini, Ed.D.
University of Southern California, 1959

Chairman: Professor LaFranchi

The purpose of this study was to analyze administrative space and facilities in high schools and to develop criteria for the adequate housing of present-day services to be performed in high school administrative units.

Data were obtained from a review of the literature and related research, from personal interviews conducted in selected California high schools with administrative units that were considered to be well planned, and by study of samples of floor plans of administrative space of California high schools of recent construction.

Findings. (1) Planning a central location for the administrative unit in relation to other plant units was an effective practice. (2) Planning the administrative unit in a quiet area was found to be effective. (3) The use of flexibility in planning the administrative unit was found to be effective. (4) Planning office space for each member of the administrative staff was considered effective. (5) Developing office space for members of the administrative staff in other areas of the school plant was less effective than planning office spaces in the administrative unit. (6) Locating the counseling offices in the administrative unit was found to be effective. (7) Locating the health unit in the administrative unit was considered a more effective practice than locating the health unit in other areas of the school plant. (8) Locating the teachers' lounge in the administrative unit was found to be a more effective practice than locating the teachers' lounge in other areas of the school plant. (9) Locating the conference room in the administrative unit was found effective. (10) Planning and locating an office workroom in the administrative unit was effective. (11) Locating the general office near the main entrance to the high school was considered effective. (12) Locating the principal's office near the general office and the main entrance to the high school was a more effective practice than locating it near the general office but not near the main entrance to the high school. (13) The location of the assistant principal's office was found to be more effective when the office was planned to be accessible to the principal, general office, and counseling suite. (14) Locating the attendance office near the health unit, director of attendance, and assistant principal was found to be an effective practice. (15) The findings of the study determined and reported the effective sizes of the several units within the administrative unit.

Conclusions. (1) There is need for planners of administrative units to consult those persons who are to use them. (2) So that administrative programs may vary with the size and type of school and the philosophy of the school district and community, there is need for planners of administrative units to build to fit the local situation. (3) A primary consideration in planning the arrangement of offices within the administrative unit is the facilitation of the program. (4) This would require a flexible type of construction and enough adaptability to permit extension to meet any required future growth. (5) It is important that all administrative and special service functions be centralized in the administrative unit.

Recommendations. (1) Planners of administrative units should consult those persons who are to use them, and should build to fit the local situation. (2) The arrangement of offices within the administrative unit should be planned to facilitate the school program. (3) A flexible type of construction with enough adaptability to permit extension to meet any required future growth should be used. (4) Administrative and special service functions should be located in the administrative unit, which should be centralized as much as possible. (5) The findings and recommendations of this investigation should be considered by planners of secondary administrative units.

Microfilm $4.45; Xerox $14.80. 345 pages.

EDUCATION, ADULT

THE PROFESSIONAL NEEDS OF COSTA RICAN EXTENSION WORKERS

(L. C. Card No. Mic 58-5584)

Fernando del Rio Sepulveda, Ed.D.
Cornell University, 1958

Purpose. The purpose of the study was to determine the professional needs of the Costa Rican extension workers and to identify principles or guidelines which might be useful in further developing extension training programs.

Procedures. A questionnaire was administered directly by the author to 64 extension workers. The questionnaire was composed of two parts; first, an inventory of the personal characteristics of the extension workers and the types of training extensionists had received prior to, and during their tenure, in the Extension Service; second, an inventory of 87 test items or problems considered important to the extension job. These problems were

obtained from farmers, housewives and youths through personal interviews, and from technicians and farmer's organizations through mailed questionnaires. Extension workers were requested to express their feeling of need for training in each one of such items or problems.

The questionnaire was pre-tested for validation and reliability was determined by the re-test technique. The problems were subsequently classified in three broad categories: 1) professional -- technical and teaching items; 2) educational -- knowledge, ability and skill items; and 3) specific subject matter -- crops, livestock, soils, extension, and others. Likewise, extension workers were classified according to position, origin, tenure in the job, professional preparation, and place of work.

Findings. Extension workers felt that the addition of some courses in the curriculum of the schools from which they graduate was needed. More need was expressed for courses in Extension Education. Extensionists also felt that various courses offered at the time of the study needed modifications.

Extensionists favored longer induction training periods. They also favored short courses -- either national or international -- for in-service training. Likewise, they favored specialization in crops and livestock for graduate studies.

Experience, position, origin and professional preparation influenced appreciably the degree of need felt by the extensionists. Supervisors felt that the field agents needed more training in subject matter of a teaching nature than of a technical nature. Similarly they felt extensionists needed more training in ability items than in knowledge or skill items.

Club assistants felt a higher degree of need for training in technical subject matter. Agricultural agents, assistant agents and field assistants felt consistently more need for training in subject matter of a teaching nature than of a technical nature. However, the difference was not statistically significant. In general the field extensionists felt higher needs for training in knowledge and skill items than in ability items.

Needs for training in specific subject matter areas were significantly affected by the agricultural regions in which the extensionists worked.

Recommendations. Any training program for the Costa Rican extension workers should include items of a technical and teaching nature, as well as of the different educational items, with emphasis appropriate for the specific groups of extensionists. The training program should also be adapted to the agricultural regions in which the extensionists work.

Training programs should be flexible to provide general types of training needed by all extension workers and at the same time specific enough to train people for specific jobs within the Service.

Training programs should be designed jointly by the supervisory staff and the field staff. Both perceived needs as well as unfelt needs of the agents should be considered.

Pre-service training could be improved by the addition of a minimum number of extension courses in the curriculum of the schools from which extensionists come. Similarly, the modification of some of the courses offered at the time of the study may strengthen the pre-service training.

The selection of one agency in each one of the agricultural regions of the country to serve as a training center for newly appointed extensionists is recommended.

The short course type of training -- either national or international -- and regional meetings should be given periodically. Short courses seem more adequate for training in subject matter of a teaching and social nature; regional meetings seem more adequate for training in technical subject matter.

The appointment of a training officer at the national level should be studied carefully. Opportunities for post graduate studies should be available to selected promising extension workers.

Any changes introduced in the present training programs should be continuously evaluated. Research in the following areas of extension is important: training programs, job performance, role expectations, organization and administration, and agricultural development.

Microfilm $3.60; Xerox $12.20. 277 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

EDUCATION, HISTORY

A HISTORY OF THE EDUCATION OF EXCEPTIONAL CHILDREN IN THE PUBLIC SCHOOLS OF SAINT LOUIS, MISSOURI, 1878-1958

(L. C. Card No. Mic 59-1746)

Kenneth Raymond Mangan, Ed.D.
Washington University, 1959

Chairman: Raymond E. Callahan

The primary purpose of this study was to trace the development of educational programs for exceptional children in the public schools of St. Louis, Missouri. A general summary of the history of this type of education in the United States and in Missouri has been presented to provide background for happenings on the local scene. An effort was made to relate the history of special education to the developments in general education and to the events of the time.

The research techniques used were those usually associated with historical method. Primary sources of information included: The Official Proceedings of the St. Louis Board of Education, Annual Reports of the St. Louis Board of Education, Laws of the State of Missouri, correspondence and records of the various special schools, the professional writing of men active in special education in St. Louis, newspaper accounts, and government reports. Other sources were special education texts, dissertations and periodical literature.

The education of exceptional children began in America during the nineteenth century primarily in private schools and in state residential schools. During this period special education was looked upon as a charitable venture. In the first half of the twentieth century, the education of exceptional children became a part of the common school program of public school systems in the cities of the United States. Compulsory education laws and the humanitarian and reform movements caused the rapid acceleration of special education in the period up to World War I. State laws encouraging and supporting the education of handicapped children became more numerous after World War I, until at the present time every state has legal provisions for exceptional children in the public schools.

St. Louis was the first city in Missouri to introduce a special school as part of the local school system, with the founding of the Gallaudet School for the Deaf in 1878. St. Louis also led the state in establishing schools for retarded children in 1908. Educational programs have been developed for crippled children in an orthopedic school, in hospitals or in their own homes, and for speech defective, partially sighted, hard of hearing and gifted children in the public schools of the city.

There are indications that all handicapped children are still not being educated adequately. In addition to an increase in the number of classes of the types already in existance, there is a need for new educational services. Some of these are: classes for the so-called "trainable" child, services for the emotionally disturbed, a program for aphasoid children and increased attention to the multiply handicapped.

Microfilm $3.85; Xerox $14.20. 300 pages.

EDUCATION, PHYSICAL

STATUS OF THE PHYSICAL EDUCATION REQUIRED OR INSTRUCTIONAL PROGRAMS FOR MEN AND WOMEN IN THE FOUR-YEAR COLLEGES AND UNIVERSITIES OF THE UNITED STATES

(L. C. Card No. Mic 59-2680)

Harold John Cordts, Ed.D.
Syracuse University, 1959

Purposes

This study was concerned with determining the current status of instructional physical education programs for men and women in colleges of the United States. Changes in practices since 1954 were summarized. An attempt was made to determine if any significant differences existed between practices in state coeducational, private coeducational, men's, and women's colleges.

Procedures

A questionnaire, constructed in terms of the principles set forth in the Washington Conference Report and reviewed by several authorities, was sent to department chairmen at 300 colleges.

Replies were received from 184 (105 men and 79 women) chairmen. Findings were presented in percents on tables and graphs with most computations based on 168. Sixteen institutions did not have programs. The chi square test was used to determine significant differences.

Findings

Generally, departments had educational philosophies and program objectives in writing. The majority of staff members subscribed to the philosophy. Objectives were compatible with the over-all philosophy of the department and institution.

Department chairmen interpreted a broad concept of physical education to students and administrators but not to the community. Standards relative to staff qualifications, academic rank, retirement, teaching load, salaries, and size of classes applied equally to the instructional physical education staff. A majority of staff members had master's degrees and the rank of instructor.

In-service education efforts were not strong. Monthly staff meetings of one hour in length were common. Staff members taught a weekly average of 15 clock hours.

Over four-fifths of classes enrolled 35 or fewer students. Classes met twice each week for a total of 119 minutes. Each period lasted 38 minutes, or 53 minutes including shower and dressing.

About one-third of departments exempt students because

of veteran's experience, intercollegiate athletics, and age. Medical exemptions were granted in two-thirds of departments.

In 58 percent of colleges, credit was granted for physical education on the same basis as for other subjects. Grade points counted toward graduation in three-fifths of institutions and toward honors at 53 percent of institutions. Over two-thirds of colleges counted these credits within the total graduation hours.

Financial support for physical education generally came from the same source as for other instructional areas. Many departments used off-campus golf and bowling facilities. Least adequate facilities on campus were golf and dance areas.

Departments generally required students to purchase prescribed gymnasium suits. No fee or deposit was paid by students in 37 percent of departments; 28 percent required fees.

Most departments required medical examinations before participation in the program. Few required annual examinations. Comprehensive records included information on college activities, medical classification, and swimming classification.

Over 60 percent of institutions had either a two- or four-semester requirement for men and women.

Very strong program units were individual sports, aquatics, and team sports. Dual sports were strong. Rhythm-dance units were moderate, but adapted activities, gymnastics-tumbling, and body mechanics were usually weak.

Coeducational activities were usually taught by men and women instructors concurrently. About one-half of departments had a planned sequence for students to follow. Specific activities were required of students in 58 percent of departments. One-third of departments provided adapted sections.

Student status was determined at the beginning, during, and at the end of the course. Factors considered in grading were skill, knowledge and understanding, attitude, and attendance. Letter grades were usually given. Evaluation measures were used primarily for grading.

More departments (36 percent) had made changes in philosophy and objectives than in any other area considered here. Changes in this area were also most often influenced by the Washington Conference.

Few significant differences were found between practices in different types of institutions.

Microfilm $3.90; Xerox $13.20. 301 pages.

THE RELATIONSHIP IN WHITE RATS BETWEEN CHANGES IN WORK CAPACITY DUE TO TRAINING AND THE EOSINOPHIL RESPONSE TO MUSCULAR EXERCISE

(L. C. Card No. Mic 59-2081)

Clifford Emerson Keeney, Ph.D.
New York University, 1959

The purpose of this investigation was to study the eosinophil response to muscular exercise of different durations in trained and untrained rats, and to determine whether there was a relationship between the magnitude of the eosinophil response and the subsequent level of adaptation acquired through training. The study offered possible contributions to knowledge of the relationship of the eosinophil response to exercise. It examined the possibility of determining adaptation potential by measuring adrenal responsiveness to exercise by means of the eosinophil response; and finally it offered a chance to investigate a possible limiting factor of work capacity.

Stress and adaptation have been shown to be closely related to the secretion of adrenal cortical hormones. The eosinophil level is highly responsive to blood levels of these hormones, showing a sharp decrease when they are present in the blood stream. It is not yet certain whether the adrenal cortical hormones determine the eosinophil response to stress. It has been demonstrated that exercise will cause a decrease in the circulating eosinophil level proportional to the duration of the exercise. The parallelism between exercise and other forms of stress has been questioned, however.

The subjects of this study were 24 male rats, 12 months old, weighing between 500 and 600 grams. The normal eosinophil level of each was determined, and all were tested for maximal swimming capacity by swimming to exhaustion. The eosinophil response was determined by obtaining an eosinophil count four hours after the end of the exhaustive swimming. Similarly, the eosinophil response to swimming one half of exhaustive swimming time was determined.

The subjects were then randomly divided into a control and an experimental group of 12 rats each. The experimental group was trained by swimming five times a week, starting at 15 minutes a day and working up to 40 minutes at the end of a six week training period. The control group was not trained.

At the end of the training period both groups were again swum to exhaustion and the eosinophil response was determined, as was the eosinophil response to half of exhaustive swimming time. In addition, the animals were swum for durations the same as their pre-training exhaustive and half exhaustive swimming times, and the eosinophil responses determined.

Analysis of variance showed that the regression of gain in work capacity of the experimental group, measured by the difference between the post-training and pre-training swimming times, was not related to the eosinophil response to either pre-training exhaustive or half exhaustive swimming. The eosinophil response was proportional to the swimming duration. In the experimental group training increased the magnitude of the eosinophil response to swimming times of comparable duration, while in the control group the eosinophil responses were the same for comparable swimming times six weeks apart. It was concluded that the eosinophil response to exercise is not related to the gain in work capacity due to training. Furthermore, the eosinophil response is proportional to the swimming duration. And finally, the eosinophil response to exercise is greater after a period of training.

Further work on the variation in magnitude and time of occurrence of the eosinophil response to exercise in humans was recommended. Also, it was suggested that the eosinophil response to exercise of different durations and intensities should be studied in man. It was recommended that the effects of emotion in complicating the eosinophil response to exercise be investigated, as well as the possibility of

developing cross-resistance to the stress of emotion by adaptation to exercise.

Microfilm $2.00; Xerox $6.20. 128 pages.

EDUCATION, PSYCHOLOGY

A SCALING OF VOCATIONAL GOAL-CERTAINTY

(L. C. Card No. Mic 59-2806)

Harold Angus Cloer, Ed.D.
Stanford University, 1959

The Problem

The purpose of the study was to investigate a technique for measuring a student's expressed opinion of the validity of his vocational plans. The principal hypothesis of the study was that a sample of college freshmen could be scaled on the continuum of expressed goal-certainty. Application of the scaling technique was to be demonstrated by investigating the relationship between vocational goal-certainty and a number of variables which the research literature suggested might be related to vocational goal-certainty.

Procedures

The principal source of data for the study was a three-part instrument: (1) a short questionnaire concerning selected characteristics of the subjects, (2) an attitude scale for measuring vocational goal-certainty, and (3) a selfrating checklist which was scored to yield "accuracy of self-rating" scores. The 20-item goal-certainty scale was constructed by the "scale-discrimination technique," with scoring adjusted on the basis of scaling analysis. The reliability and homogeneity coefficients for the scale scores were above 0.90 for both the pilot and study samples.

Three other sources of data were used in the study: the Mooney Problems Checklist, to obtain a report of general adjustment concerns, the Kuder Vocational Preference Record, to obtain a measure of interest "patterning," and the A.C.E. Psychological Examination, to obtain a measure of scholastic aptitude.

A pilot study was conducted in 1956 to standardize the instruments and procedures. The study sample (proper) consisted of the 179 men and 112 women who entered Southern Oregon College, Ashland, Oregon, as freshmen at the beginning of the Fall term, 1956-57. The three-part "Vocational Planning Questionnaire" was administered four times to those remaining in attendance during the year: twice at the beginning of the Fall term, one week before the end of the Fall term, and one week before the end of the Spring term. These data were also obtained at the beginning of the Fall term: criterion data for scoring the self-ratings, the scholastic aptitude indicator, and the interest "patterning" indicator. To obtain a measure of "general concerns," a problems checklist was administered at the end of the Fall term to the 88 per cent of the sample who were attending classes. Near the end of the subjects' sophomore year, in June of 1958, a group was identified whose majors had not changed since entering college; a second group whose educational-vocational plans had changed during the two-year period was also identified.

The Findings

1. The vocational goal-certainty scale produced scores which were reliable, homogeneous, and capable of discriminating between groups differing in stability (and specificity) of educational-vocational plans.
2. No significant relationship was found between vocational goal-certainty and: (a) age, (b) scholastic aptitude, (c) military service status, (d) women's grades, and (e) interest "patterning."
3. The mean goal-certainty score of the female sample was significantly higher than that of the male sample. The scores of the female subjects remained relatively unchanged over the year, while those of the men dropped greatly and then recovered slightly during the freshman year.
4. A small negative relationship was found between the men's goal-certainty scores and achieved grades.
5. A small negative relationship was found, for both the male and female subjects, between goal-certainty scores and the number of non-vocational concerns reported.
6. The vocational goal-certainty scores of married male subjects were significantly higher than those of unmarried male subjects.

Conclusion

A sample of college freshmen were ordered on the goal-certainty dimension, and the usefulness of the technique for research and guidance was illustrated.

Microfilm $2.80; Xerox $9.60. 215 pages.

A COMPARATIVE STUDY OF PERSISTING AND NON-PERSISTING MINISTERIAL CANDIDATES IN EVANGELICAL COLLEGES

(L. C. Card No. Mic 58-3148)

Harold William Darling, Ph.D.
Purdue University, 1958

Major Professor: Elizabeth K. Wilson

The purpose of this study was to ascertain characteristics that differentiate candidates in evangelical colleges who persist in ministerial training from those who withdraw from such training.

Questionnaires were sent to 383 ministerial candidates who had enrolled as freshmen in the fall of 1952 in fifteen four-year colleges, four two-year colleges, and four Bible colleges of evangelical persuasion. These schools, listed in Evangelical Christian School Movement, indicated they were evangelical or "fundamentalist" in theological belief. Completed questionnaires were received from 265 individuals. The questionnaires were divided into two categories: persistent and non-persistent ministerial candidates. After eight unclassifiable returns were deleted from the study, groups of 229 persistent and twenty-eight nonpersistent candidates were formed. Percentiles on psychological tests were obtained from college officials for 89.5 per cent of the total group. Guilford-Zimmerman Temperament Surveys were mailed to the candidates. Approximately 70.5 per cent were completed and returned.

It was hypothesized that persistent candidates could be differentiated from non-persistent candidates in the

following respects: earlier initial consideration of the ministry; more frequently "called" to the ministry; higher intelligence; more altruistic in their motivation for entering the ministry; longer duration of membership in their churches; more frequent coincidental first consideration and final decision to enter the ministry; and significantly higher scores on one or more traits of the Guilford-Zimmerman Temperament Survey.

Statistical treatment of the hypotheses showed that persistent candidates may be differentiated from non-persistent in that: (1) a greater proportion have a "call" to the ministry; (2) they achieved significantly higher scores on the trait "Thoughtfulness" of the Guilford-Zimmerman Temperament Survey. These findings were significant statistically at the .01 and .05 levels, respectively.

The motivation of persistent candidates appeared to be somewhat more altruistic than that of non-persistent candidates, although the numbers were not of sufficient size to permit statistical analysis.

Although differences were not statistically significant, persistent candidates scored higher on psychological tests, more frequently made initial consideration and final decision for the ministry within the same year, and made higher scores on all but two of the Guilford-Zimmerman Temperament Survey traits. Traits on which persistent candidates surpassed non-persistent candidates below the level for significance were: "General activity," "Restraint," "Ascendance," "Sociability," "Emotional stability," "Objectivity," and "Friendliness."

Although not verifiable statistically because of the small numbers involved, it appeared that candidates giving first consideration to the ministry either before age thirteen or after twenty-five tended to persist in ministerial training. It was impossible, for the same reason, to verify statistically a relationship between altruism and persistence. Whereas no persistent candidate was non-altruistically motivated, 30.9 per cent of the non-persistent made non-altruistic responses. All who made their initial consideration of the ministry after they entered college persisted in their planning. Making final decision for the ministry while in college were 28.6 per cent of the persistent, 6.3 per cent of the non-persistent. Neither of these findings can be statistically tested because of the limited numbers involved.

The most pronounced limitation of the study was the small number, twenty-eight, of non-persisting respondents, making extensive statistical analysis impossible.

Recommendations were made for research in the following areas: (1) the relationship between the "call" and characteristics essential to ministerial success; (2) a scale evaluating the personality traits needed by ministers; (3) the influence of sociological factors related to persistence; (4) a comparison of the persistence of ministerial candidates given scholarships and other inducements to enter the ministry with other candidates; and (5) the degree of criticalness of the dropout problem in evangelical and liberal denominations.

Microfilm $2.15; Xerox $7.60. 162 pages.

ATTITUDES OF STUDENT ETHNIC GROUPS ON ISSUES RELATED TO EDUCATION

(L. C. Card No. Mic 59-2609)

George D. Demos, Ph.D.
University of Southern California, 1959

Chairman: Professor Earl F. Carnes

The purpose of this investigation was to ascertain whether or not significant attitudinal differences toward education existed between Mexican-American and Anglo-American pupils, and if these differences were concomitant or associated with minority group membership. The study attempted to isolate some of these differences of attitudes in pupils from grades seven through twelve.

A stratified random sample of Mexican-American youngsters were selected—35 from the seventh-eighth grades, 35 from the ninth-tenth grades, and 35 from the eleventh-twelfth grades. In a similar fashion 105 Anglo-Americans were randomly selected with an equal number in each of the grade groups. The third group consisted of 105 Anglo-Americans that were matched with the Mexican-American sample on age, grade, sex, social class, and intelligence.

The method of successive intervals was the scaling technique utilized in developing the attitude scales. Five intervals were described: (1) highly favorable, (2) favorable, (3) neutral, (4) unfavorable, and (5) highly unfavorable. No assumption was made concerning the psychological equality of the category intervals. It was assumed only that the categories were in correct rank order and the boundary lines were stable. The various statements were rated into the successive intervals by a group of seven judges according to the degree of favorableness-unfavorableness that each statement was assumed to express. In its final form the Opinion Survey consisted of twenty-nine issues. After individual administration, the results of the administration of the attitude scales were summarized, and the statistical methods of chi-square and analysis of variance were utilized to determine if significant differences existed.

Conclusions. Significant differences of attitude are found among the Mexican-American and Anglo-American groups. There are more differences between the randomly selected Anglo-Americans and Mexican-Americans than between the matched Anglo-Americans and Mexican-Americans. In every case where a difference if found between the random samples, the Anglo-American groups have the more desirable attitude. In the matched sample comparisons, in only one case do the Mexican-American students have what is considered the more desirable attitude. However, the general agreement between the Mexican-American and Anglo-American subjects is greater than the disagreement. Matching of the Mexican-American and Anglo-American groups does reduce the number of differences of attitude. However, there still exist six significant differences that can be accounted for only as differences due to Mexican-American ethnic group membership. It also appears that the change of attitudes occurs at the ninth and tenth grade levels and continues to exist through the twelfth grade. The seventh-eighth graders hold the most desirable attitudes, while the eleventh-twelfth graders hold the least desirable. This fact is

apparent for both the Mexican-American and Anglo-American groups. While there are some differences of attitudes found to exist among the three Anglo-American grade groups, fewer differences are found within the Anglo-American groups than within the Mexican-American groups. This suggests that there is more general agreement among the Anglo-Americans than among the Mexican-Americans toward the twenty-nine issues. The data also indicate that a definite relationship exists between intelligence and attitudes, achievement level and attitudes, social class and attitudes, language spoken in the home and attitudes, and generation in the United States and attitudes.

Recommendations. The findings of this study should have special meaning for guidance workers, teachers, administrators, and parents. A concerted effort by all is essential at the crucial times indicated to carry out successfully any program of securing desirable attitudes of both Mexican-American and Anglo-American students.

Microfilm $3.65; Xerox $16.40. 282 pages.

READING BEHAVIOR, ACHIEVEMENTS AND ATTITUDES OF FIRST GRADE BOYS

(L. C. Card No. Mic 59-2821)

Daniel Emil Johnson, Ph.D.
Stanford University, 1959

According to their behavior toward reading instruction as determined by a specially devised rating scale, 101 unselected first grade boys were divided into Eager and Reluctant groups. These divergent behavior groups had equal Metropolitan Readiness scores and approximately equal Goodenough mental ages. At the end of first grade they took the Gilmore Oral Reading Test and the Wide Range Reading Test, and told projective stories about nine pictures of reading situations. Other data were known from school records.

Analysis of the projective stories using Cureton's Chi Test for item significance showed the presence of five attitudes characteristic of the Eager group:

(a) I have a specific role in learning to read and I look for the specific materials and methods involved.

(b) I get anxious in reading situations.

(c) In reading, I accept the teacher's opinions and tools--someday I will be rewarded.

(d) Reading situations remind me of the harshness in the world around me.

(e) I like books.

Four attitudes were characteristic of the Reluctant group:

(a) Reading makes me fall behind or isolates me.

(b) Reading itself is unpleasant.

(c) Reading brings punishment.

(d) Reading interferes with fun.

Five attitudes were common to both groups:

(a) Reading involves certain classroom routines.

(b) Reading situations involve certain minor misbehaviors.

(c) The teacher is likely to add to a fellow's discomfort if he is already uncomfortable when reading.

(d) Reading situations can involve unfriendliness between children.

(e) Showing off my reading achievement is a pleasure.

The Eager group, although equal to the Reluctant group in intellectual readiness, exceeded it in all areas of reading achievement measured. These differences in achievement remained or widened during the second grade when the Wide Range and Gilmore were repeated.

The projective test data were tested for validity, and the attitude findings held in a cross-validation study. Reliability was checked by an independent scoring and about 90 per cent agreement occurred between the two scorers. Agreement was high because the scoring system depended upon actual words used by the subjects rather than interpretations and opinions of the scorers.

Experts in the field of reading assert that emotional learnings and attitudes are more important than intellectual learnings. For this reason it is suggested that children be grouped for primary reading instruction on the basis of their attitudes. The findings of this study justify differential teaching methods for eager and for reluctant boys. Grouping might allow also for differences in teacher attitudes, giving teachers whole classes with which they are attitudinally effective without homogeneous grouping on an intellectual basis.

Before actually grouping children according to their attitudinal readiness, other research is needed. The questions to be answered include whether relationships found in this study at the end of first grade could be found early in first grade; whether girls would also benefit; whether the desired changes in student attitudes could be effected in some more simple way; whether the data in this study would be found in other school districts; and whether a community would be willing to cooperate in such an experiment.

The data also suggest the possibility of early prediction of reading difficulty, the possibility of using similar methods to explore student attitudes in other areas of instruction, and the possibility of validating other tests and interview techniques by processes similar to those in this study.

The hypothesis has been demonstrated that first grade teachers can reliably rate the reading behavior of their students and that these ratings do have meaning in terms of the children's attitudes and achievement and that the data do have implications for educational processes.

Microfilm $2.40; Xerox $8.40. 183 pages.

THE EFFECTS OF A PRE-ENTRANCE ORIENTATION COURSE ON THE ADJUSTMENT OF SIXTH GRADE PUPILS TO JUNIOR HIGH SCHOOL

(L. C. Card No. Mic 59-2218)

Harold Kobliner, Ph.D.
New York University, 1959

Problem

The purpose of this investigation was to develop a pre-entrance orientation course for sixth grade pupils and to determine its effectiveness in preparing them for junior high school by comparing a control and experimental group on six aspects of school adjustment: (1) absence rate; (2) attitude towards school; (3) teacher ratings of behavior; (4) grades; (5) number of problems indicated on the Mooney Problem Check List; and (6) social acceptance.

Procedure

The population consisted of 35 control and experimental pupils randomly chosen from the sixth grade.

The experimental group met with the investigator once a week for ten weeks during the spring term. The course included a visit to the junior high school, a talk by the junior high school guidance counselor, conferences with seventh and ninth grade students, slides depicting activities of the junior high school and group discussions about junior high school.

Application of the six criterion measures was considered the pre-test and later compared with the results obtained from two follow-up testing periods in junior high school, at the first and second marking periods.

Supplementary data were obtained from logs, compositions and questionnaires.

Results

The only significant difference found was that both groups indicated significantly greater numbers of favorable comments about junior high school for the second marking period than they did for the initial weeks of the term.

The following tests of the hypothesis failed to produce support:

1. Differences between the mean changes shown by the control and experimental groups for attitude, behavior ratings, grades and problems between the mid year of the sixth grade and the first marking period in the junior high school.
2. Differences between the mean changes shown by the control and experimental groups for attitude, behavior ratings, grades and problems between the first and second marking periods in junior high school.
3. Differences between the mean changes shown by the control and experimental groups for attitude, behavior ratings, grades, problems and social acceptance between the mid year of the sixth grade and the mid year of the seventh grade, the crucial test of the hypothesis.
4. Difference between the changes in Index of School Adjustment scores shown by the control and experimental groups between the mid year of the sixth grade and the mid year of the seventh grade, the crucial test of the hypothesis.
5. Difference between the mean rates of absence for the control and experimental groups at the first marking period in junior high school and again at the second marking period in junior high school.
6. Difference between the sixth grade compositions of the control and experimental groups on the number of favorable and unfavorable comments made about the prospects of entering junior high school in the fall term (though it approached the five per cent level of significance, with the experimental group having the greater number of favorable comments).
7. Difference between the daily logs of the control and experimental groups on the number of favorable and unfavorable comments made about junior high school during the first three weeks of the seventh grade.
8. Difference between the seventh grade compositions of the control and experimental groups on the number of favorable and unfavorable comments made about the junior high school at the end of the first marking period.
9. Difference in appraisal made by parents of the control and experimental groups concerning their children's adjustment to junior high school.

Conclusion

The pre-entrance orientation course developed in this investigation failed to affect significantly the behavior of the experimental pupils once they had entered junior high school. Microfilm $3.00; Xerox $10.20. 231 pages.

CORRELATES OF INTRACEPTION

(L. C. Card No. Mic 58-2304)

Jacob Joseph Levin, Ed.D.
Syracuse University, 1958

Adviser: W. J. Dipboye

Purpose

Sensitivity to the needs, motives and drives of other people is an attribute which is of great importance to modern educators. It is believed to be an integral part of the teacher's ability to adapt academic content to the needs of his students. It can provide the administrator with a subjective measure of the interaction of his staff. It is the basis of the counseling relationship. Intraception is used to describe this sensitivity to the needs, motives and drives of other people.

Murray (28) developed a Need Theory as a way of describing personality. Intraception, and the correlates of Intraception, were discussed in his theory. Edwards, using Murray's theory of needs, designed and published the Edwards Personal Preference Schedule purporting to measure fifteen of the needs which Murray described. The purpose of this study was to examine some of the correlates of Intraception using a portion of the Edwards Personal Preference Schedule as a measure of Intraception and Murray's theory as the basis of the questions raised. This was done by first discussing some of the theoretical correlates of Intraception. They were: (1) Sex. (2) Age. (3) Religion. (4) Size of Family. (5) Size of Community. (6) Interests. (7) Attitudes.

Having described the theoretical relation between Intraception and these variables, the research related to Intraception was described briefly. A survey of the literature revealed that very few articles have been written on Intraception. What was written, however, indicated that projective tests could be scored for Intraception. It was also found that Intraception was not related to parental occupation, Age or Intelligence. Research indicated that females scored higher than males.

Method

From this first portion of the study six questions were raised: (1) What is the relationship between a person's Intraception score on the E.P.P.S. and his tendency to attribute needs, motives and drives to people who appear in projective pictures? (2) What is the relationship between Intraception, Sex and Age? (3) What is the relationship between Intraception and Intelligence? (4) What is the relationship between Intraception and Attitudes? (5) What is the relationship between Intraception and Interest? (6) What is the relationship between Intraception and certain environmental factors?

The data used to answer these questions were obtained from tests given to volunteer junior and senior education students at Syracuse University. The tests used were: (1) A group TAT type test. (2) Edwards' Personal Preference Schedule. (3) The Inventory of Beliefs. (4) The California F Scale. (5) The Strong Vocational Interest Blank. (6) The A.C.E.

A personal data questionnaire was used to obtain personal data about the subjects.

The statistical techniques used to answer the questions were the Pearson product moment correlation, the Critical Ratio, t-test and the Analysis of Variance.

Conclusions

Analysis of the data indicated a positive relationship between a persons Intraception score on the E.P.P.S. and his tendency to attribute needs, motives and drives to people who appear in projective pictures.

The data failed to answer conclusively the remaining five questions. Microfilm $2.45; Xerox $8.60. 188 pages.

DIFFERENCES IN PERFORMANCE ON STANFORD-BINET ITEMS OF CHILDREN WHO FUNCTION ABOVE AND BELOW GRADE LEVEL IN WORD RECOGNITION

(L. C. Card No. Mic 59-2668)

Mildred Post, Ph.D.
Syracuse University, 1959

The causes or factors contributing to poor reading are now and have been for many years a matter for discussion among educators and psychologists. It was intended that this investigation would add to our knowledge of these factors through a comparison of Stanford-Binet patterns of children who perform above and below grade level in word recognition.

It was the purpose of this study to show that children who function above and below grade level in word recognition would manifest different patterns of performance on the Stanford-Binet. The test is so constructed that at each year level there is a variety of areas tested. It was hoped that because of the nature of the Binet, the test would lend itself to the analysis of such specific problems as:

1. Do poor readers do more poorly on items requiring sustained attention than do good readers?
2. Do poor readers do more poorly on items requiring visual memory than do good readers?
3. Do poor readers do more poorly on items requiring auditory memory than do good readers?
4. Do poor readers do more poorly on non-verbal items than do good readers?
5. Do poor readers do more poorly on vocabulary items than do good readers?

The term good reader shall mean children whose word recognition skills are at least one year above grade level. The term poor reader shall mean children whose word recognition skills are at least one year below grade level. It is recognized that word recognition without meaning is not reading but it is felt that the term "poor readers" is easier to handle from the point of sentence structure and easier to read than "children who perform below grade level in word recognition."

Grade level shall mean the grade plus the period of time spent in the grade at the time the child was tested. Thus a fourth grade child tested in February must perform at a 3.5 level or below in word recognition to be called a poor reader. Conversely, a fourth grade child tested in February must perform at a 5.5 grade level or above in word recognition to be called a good reader.

Word recognition shall be defined as the ability to recognize isolated words or ability to analyze the word form.

One general and five specific purposes have been suggested. In line with these purposes it is hypothesized that children who function above grade level in word recognition manifest no differences in patterns of performance on the Stanford-Binet than children who function below grade level on word recognition; more specifically:

H_1: There are no differences between the groups on items requiring sustained attention.

H_2: There are no differences between the groups on items requiring visual memory.

H_3: There are no differences between the groups on items requiring auditory memory.

H_4: There are no differences between the groups on non-verbal items.

H_5: There are no differences between the groups on vocabulary.

The subjects were 40 good readers and 40 poor readers from the latter part of the first grade through grade six. They were matched for chronological age, mental age and intelligence quotient at each Binet level from year VII through year XII. F and t-tests were used to determine significant differences between the means and variances for these three factors. The .05 level was accepted as showing significant differences between the groups except when the total N was less than 30. When the total N was less than 30 the .10 level was used.

The tests administered were Form L of the Revised Stanford-Binet and the word recognition list of the Durrell Analysis of Reading Ability.

Chi square was used to determine whether poor readers and good readers differed on each item.

The one area considered in this study in which there were significant differences was digits reversed or, as it has been called, sustained attention. There were four items included in auditory memory. For two of these items (digits reversed and sentence memory) there were differences that were significant. Differences for the other two items (digits forward and memory for stories) were not significant. Differences for items included in visual memory, vocabulary and non-verbal areas were not significant. Microfilm $2.00; Xerox $4.00. 73 pages.

THE BASE LINE IN CHILDREN'S DRAWINGS OF SELF AND ITS RELATIONSHIP TO ASPECTS OF OVERT BEHAVIOR

(L. C. Card No. Mic 59-1766)

Jessie Wall, Ed,D.
The Florida State University, 1959

The first purpose of the study was to establish whether or not children projected a base line (horizontal line or symbol of a line upon which the child stands himself or other environmental symbols) into drawings of themselves. From a stratified sample of 1667 children of normal intelligence ages 3 through 8 (rural, urban, suburban) (north, south) (bi-racial) (private, parochial, public and pre-school) were collected 5001 crayon drawings of: (1) self, (2) self in the future, (3) map of going from home to school. These drawings were analysed as to the inclusion and exclusion of a base line. Age and sex differences were noted.

The second purpose of the study was to establish criteria for estimating readiness to cooperate with environment with understanding that was developmental from ages 3 through 8. Part I of the Criteria (Interpersonal relations) was answered by the teachers of the children and Part II (Environmental Understandings) was analysed as to the kind, amount, and organization of the environmental data presented by the child.

The third purpose was to test an hypothesis that no relationship existed between the inclusion of the base line in the child's drawings of self and his readiness to cooperate with his environment with understanding. The relationship sought was developmental or parallel and not reversible cause and effect. Hence, if at any age from 3 through 8 there was no significant difference at the .05 level of confidence the hypothesis would be rejected.

Findings of the Study

As to the inclusion of the base line:

1% of the children include the base line at age 3. 96% in-96% include it at age 8.

The mean age when the base line is included more than excluded is 5 years, 10 months, and 4 days.

Females include the base line more often than males until age 8 where males exceed.

As to the criteria for Cooperation with Environment with Understanding:

13% of the females scored YES on the criteria at age 3. 94% of the females scored YES at age 8.

10% of the males scored YES on the criteria at age 3. 93% scored YES at age 7.

Environmental understandings and readiness to cooperate with them preceded conceptualization of them as projected by the base line symbol until the end of the 6th year.

There were wider latitudes of individual differences as to the amounts and kinds of environmental data presented by the child within the Age-Intervals than between the intervals.

As to the relationship of the Base Line to the criteria for Cooperation with environment with understanding.

At age 3 and age 7 the relationship of inclusion of the base line and YES score on the criteria were significant at the .05 level for both sexes, and for girls at the age 8 interval.

The hypothesis was rejected.

87% of the children who included the base line also scored YES on the criteria.

A method was explored for further examination of aspects of overt behavior as expressed by symbols the child used as he drew himself within the context of the place he occupied in his environment.

Microfilm $2.00; Xerox $7.20. 152 pages.

EDUCATION, RELIGION

THREE PURITAN ATTITUDES TOWARD LEARNING: AN EXAMINATION OF THE PURITAN CONTROVERSIES OVER A LEARNED MINISTRY, 1640-1660, AND THE CONSEQUENCES OF THIS STRUGGLE FOR PURITAN CONCERN ABOUT THE REFORMATION OF LEARNING.

(L. C. Card No. Mic 59-2589)

David Johnston Maitland, Ph.D.
Columbia University, 1959

While historians have made a variety of conflicting judgements regarding Puritan attitudes toward learning, it may be said with certainty of the English Puritans of the period 1640 - 1660 that they were supporters of learning. Although such a statement is true it is relatively unimportant because it fails to indicate that both Puritanism and learning meant many things in the seventeenth century. Learning was undergoing a change which was to have far reaching consequences, and, after 1640, Puritanism was not one but several divergent "parties." Therefore, it is necessary both to distinguish between the forms of learning and to demonstrate what the "parties" within Puritanism thought about these forms and about the ends which learning should have served.

The two extreme "parties" within the Puritanism of this period were engaged in a struggle for control of the English Puritan reformation. This struggle, which had its source in a fundamental disagreement about the use of reason in the Christian life, seriously influenced the attitudes of Sectarian and Conservative Puritans toward learning and the universities. The Conservatives, although recognizing that learning was incompetent to achieve the experience of saving grace which all Puritans prized, insisted upon the use of reason both prior to and following the experience of regeneration. Favoring a learned ministry traditionally educated, the Conservatives had little natural interest in the new Baconian science. What limited interest they may have had was obscured in their defence of the traditional curriculum against the attacks of the Sectarians.

With but one exception the Sectarians had no startling

proposals for the reformation of learning. They did oppose the learned ministry and they attacked the universities in which such clergy were trained. In this they added their voice to criticism which came from humanistic and scientific quarters. Latterly the most formidable Sectarian critic, John Webster, discovered that on the basis of a common dualistic epistemology he could use Baconian criticism of scholasticism in his polemic against the Conservatives. This opportunism, while effective in ecclesiastical dispute, did not yield responsible proposals for the universities.

Between these two extremes, whose proposals about learning were largely dictated by their controversy over the learned ministry, stood a party which has been designated the Puritan Moderates. This "party" was able to avoid direct involvement in the ecclesiastical controversy without being indifferent to the church and its reformation. The Moderates were able, therefore, to look more sympathetically at both the traditional curriculum and at the rising science and to provide a place for both in their vision of a truly reformed university.

In each case a somewhat different understanding of the most important factor in the English Puritan reformation influenced the three parties attitudes toward learning. Emphasizing exclusively the individual experience of regenerating grace to which no human achievement was relevant, the Sectarians rejected the traditional curriculum and the ministry trained in it. They urged an empirical approach to the knowledge of nature and justified education on purely civil grounds. The Moderates, on the other hand, saw the church as the central factor in the reformation and urged a learned ministry as the key to the needed ecclesiastical reform. As a result they supported university education largely as it stood. While the Moderates appreciated the traditional Puritan emphasis upon unmerited regeneration and also acknowledged the need for a learned ministry in the reformation of church and society, they would seem to have been unique in their emphasis upon social amelioration as the imperative of a Puritan reformation. As a result they envisaged a more comprehensive curriculum and more comprehensively reformed learning than did either of the extreme "parties" without sacrificing the traditional studies or opposing the introduction of new methods for the acquisition of learning.

Microfilm $3.75; Xerox $12.80. 292 pages.

EDUCATION, TEACHER TRAINING

THE DEVELOPMENT OF AN IN-SERVICE TRAINING PROGRAM IN AUDIO-VISUAL METHODS THROUGH TELEVISION

(L. C. Card No. Mic 59-2804)

Joel Avery Benedict, Ed.D.
Stanford University, 1959

The research reported in this dissertation was designed to determine, through experimental study, the effectiveness of instruction in a college extension course in Audio-Visual Methods taught by television as compared to the effectiveness of instruction of the same course taught by usual means. The first offering was made during the fall semester of 1957. The television course was broadcast live over KTVK, Channel Three, in Phoenix, and by kinescope recording over KGUN, Channel Nine, in Tucson, while the control course was taught at Granada School in the Alhambra District in Phoenix.

The experiment was repeated during the spring semester of 1958 over the same television stations, and the control course was taught in the Madison School District in Phoenix. The same course topics or lessons were taught with television and without television. The same text books, activity manuals, and assignments were used by the television class and control class. Data was collected from weekly assignments, final examinations, and questionnaires and evaluated to determine the achievement of students, and to determine the students' feelings about their accomplishments as well as to determine their feelings about teaching by television.

A tabulation was made of the residences of students to determine their location in Arizona with relationship to Arizona State College.

The results of the final examinations of both the experimental and control groups for each semester were compared by computing the means, standard deviation, and range of scores. The significance of the difference between the means of the experimental and control groups was computed each semester. No statistical significance was found. The co-efficient of the reliability of the final examination was computed by the odd-even correlation scheme, using the Spearman-Brown step-up formula. This co-efficient was .787 for the first semester and .6924 for the second semester.

Responses to the questionnaire showed marked agreement in that students reported they had learned as much over television as they would have learned in a conventionally taught course. They also reported that it was more interesting than a conventionally taught course.

Advantages of television teaching reported by students were

1. Convenience of staying at home, saving of time and energy, and freedom from distractions.
2. Better preparation and presentation of lessons by instructors.
3. Added interest and learning resulting from the use of many visual materials.
4. Centering of attention on one thing at a time made it easier to concentrate on subject under discussion.

The disadvantages of television teaching were reported by students as

1. Lack of immediate two-way communication did not permit students to ask questions.
2. Programs moved too fast, allowing insufficient time for note taking.

The results of the final examination, the weekly assignments, course grades and questionnaire favorably supported the hypothesis that the achievement of students in an Audio-Visual Methods course would be significantly related to the achievement of conventionally taught students.

There was some evidence of lack of motivation or interest in the experimental groups where an average of 88.3 per cent of the students completed the course, while in the control groups an average of 98.13 per cent completed the course.

During the two semesters, sixty students registered for the television course. They were located in twenty-four Arizona communities spread geographically over half the state. Twenty-three students were over one hundred miles from Arizona State College.

It is concluded that in-service instruction in Audio-Visual Methods by television is as effective as the same course taught by conventional means, and that the range of the instruction is greatly extended.

Microfilm $3.20; Xerox $11.00. 248 pages.

A STUDY OF STAFFING PROBLEMS IN COMMUNITY COLLEGES AND TECHNICAL INSTITUTES OF THE STATE UNIVERSITY OF NEW YORK WITH PARTICULAR REFERENCE TO PROBLEMS OF IN-SERVICE PROFESSIONAL DEVELOPMENT

(L. C. Card No. Mic 59-2465)

Ibrahim Abdul-Aziz El-Sherbini, Ph.D.
Cornell University, 1959

In view of the expanding technology of this country, and the increasing nationwide shortage of teachers to meet the "tidal wave" of students, the problems of staffing of institutions of higher education seem urgent. The writer devoted himself to two-year institutions at the post-high school level of the State University of New York. He examined the problems of staffing and recruitment, with particular emphasis on problems of in-service development, in these institutions.

The writer used three methods of investigating these problems: (1) a questionnaire for teachers in these institutions; a similar one for administrators there (2) interviews of both teachers and administrators at these institutions and (3) a review of available literature relating to staffing and in-service development in two-year post-high school programs, secondary schools, and industry.

He divided his study into four parts: (1) examination of data as revealed by the questionnaires about the teachers' background and experience (2) study of the motivation of the faculty (3) examination of the opportunities for in-service development now being provided and (4) comparison of these opportunities with those offered at comparable institutions.

His conclusions follow: (1) That the problems of recruitment in these institutions arise from five factors: the low salaries there, the lack of opportunities for in-service development, the low prestige of the institutions, the heavy teaching loads, and, to a lesser extent, the advancement policies at these institutions. (2) That teachers show a high degree of desire for self-development and that administrators consider self-development equally important but that these institutions are not providing financial subsidies nor a proper climate for professional development, even to the extent that administrators feel is needed.

His suggestions for alleviation of these problems are presented, together with suggestions for adaptation of certain in-service development practices used in industry.

Microfilm $2.00; Xerox $7.00. 147 pages.

AN ANALYSIS OF THE PREPARATION OF CHEMISTRY TEACHERS FOR SELECTED SECONDARY SCHOOLS AS IT RELATES TO THEIR SUCCESS

(L. C. Card No. Mic 59-2891)

James E. Koken, Ed.D.
The Pennsylvania State University, 1959

The purpose of this study was to determine (1) the undergraduate courses in science, mathematics, and education completed by teachers of chemistry in the service area of the State Teachers College located at Millersville, Pennsylvania, (2) the relationship this preparation had to their success in teaching as indicated by student ratings, (3) to secure the teachers' recommendations regarding the preparation in science, mathematics, and education to be required for certification in science, and (4) to obtain other information regarding the preparation and work of teachers of chemistry.

The data for the study were obtained:

1. From records in the Bureau of Teacher Certification and Education, Department of Public Instruction, Harrisburg, Pennsylvania.
2. From interviews with fifty-one chemistry teachers.
3. From ratings of teaching effectiveness as indicated on a performance scale checked by the students of the chemistry teachers.

When the means for the semester hour preparation in science, mathematics, and education, the means of the student ratings on the performance scale, and the means of the recommendations of the teachers of chemistry in science, mathematics, and education for certification in science were calculated, a basis for certain comparisons was evident.

Comparisons were made by testing the significance for a difference between the means; a difference was not considered significant unless it was at the .05 level of confidence or better.

The chemistry teachers who were liberal arts college graduates showed a significantly greater preparation in science and mathematics than the teachers college graduates. They also showed greater ability to make the subject matter understandable and meaningful to their students. The students in the classes of the chemistry teachers rated their chemistry teachers significantly better than their other teachers in their ability to make subject matter understandable and meaningful.

The teachers of chemistry recommended fifty-one semester hours of science and mathematics and twenty-three semester hours in education, including student-teaching, as the minimum preparation for the certification of science teachers on the secondary level. They also recommended seventy-eight semester hours in science and mathematics and twenty-seven semester hours in education as their optimum requirements for the certification of science teachers.

The miscellaneous data secured by the study relate to:

1. Certification held by the teachers of chemistry.

2. Teaching experience of the teachers of chemistry.
3. Extent of the graduate work of the teachers of chemistry.
4. Number of schools offering chemistry and percentage of school population enrolled in chemistry.
5. Additional courses in science recommended by the teachers of chemistry which would improve their effectiveness.
6. Courses in professional education of greatest value to the teachers of chemistry.
7. Membership of teachers of chemistry in scientific and professional organizations.
8. Courses other than dhemistry taught by the teachers of chemistry.
9. Suggestions of ways that the State Teachers College at Millersville, Pennsylvania, could meet to greater degree the desires of teachers of chemistry.
10. Frequency of laboratory work and demonstrations in chemistry classes.

Microfilm $2.00; Xerox $6.60. 137 pages.

A COMPARISON OF TEACHERS' RESPONSE PATTERNS ON THE MINNESOTA MULTIPHASIC PERSONALITY INVENTORY WITH RESPONSE PATTERNS OF SELECTED NON-TEACHER GROUPS

(L. C. Card No. Mic 59-2777)

Elmer Christian Rieck, Ph.D.
The University of Wisconsin, 1959

Supervisor: A. S. Barr

The purpose of this study was to identify and compare profile patterns of teachers with the profile patterns of selected non-teacher groups of students at the University of Wisconsin on the group form of the Minnesota Multiphasic Personality Inventory. The three main groups studied, divided according to sex, were students who were graduated from the University of Wisconsin with teaching certificates, students with majors in Letters and Science who did not prepare for teaching, and students who dropped out of the university prior to starting the junior year. Those who prepared for teaching were further subdivided into academic and special field majors.

Conclusions were drawn with reference to four questions:

1. What, if any, MMPI profile patterns are found for students who were graduated from the University of Wisconsin with teaching certificates?
   a. Graduates of the School of Education with academic majors.
   b. Graduates with teaching certificates in special fields--Home Economics, Music, Agriculture, Art Education, and Physical Education.
2. What, if any, profile patterns are found for students who were graduated from the College of Letters and Science but did not prepare for teaching?
3. What, if any, profile patterns are found for students who dropped out of the university prior to starting the junior year?
4. If profile patterns are found, how do they compare among the groups?

While most of the earlier researches on the MMPI were done in a hospital setting, research has been conducted in a variety of situations with normal persons, especially with university students.

The Design of the Study

The study here reported was of the comparative-descriptive type in which groups of prospective teachers and non-teaching groups were compared upon scales and profile patterns of the Minnesota Multiphasic Personality Inventory. In an exploratory study such as this it seemed best to work with a well defined population about whom precise and rather complete information could be had. The study concerned students enrolled at the University of Wisconsin during the fall semesters of 1949, 1950, and 1951.

The present study was designed to obtain more information about the suitability of using the MMPI with University of Wisconsin students in academic and vocational guidance, especially in the selection of future teachers. The MMPI is a widely used instrument and has been found useful in clinical studies. It is important that its value for this particular purpose should be ascertained.

The data were analyzed through the use of Yule's formula for differentiation of groups.

$$e\,2_{12} = \frac{pl\ q_1}{n^1} + \frac{p_2\ q_2}{n^2}$$

The significance of differences between the groups were determined by the use of this formula.

Difference in profile patterns were found in six comparisons made for each sex.

Findings

The detailed findings briefly summarized were:

1. The most important and highly significant finding is the fact that statistically significant differences did occur among all groups.
2. The data reveals that there were fewer differences among the graduates with teaching certificates in the academic fields as compared with the graduates with teaching certificates in the special fields than between any other groups.
3. The largest number of significant code type frequencies occurred in the group of students who dropped out of the university.
4. The data shows that more differences in frequencies of code types in male groups occurred than in female groups.

Conclusions

This study seems to indicate that significant differences in profile patterns on a personality test can be found between groups of college students with different academic histories. While the study has been limited by the small numbers of persons in some sub-groups, nevertheless, personality differences as represented by significant differences in patterns of scales of the MMPI did occur.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

Research is being continued to determine what the profile patterns may mean. In this respect, counseling experience and further research may help.

There are many interesting and difficult problems in research design for this area. Group research techniques may be employed in building a usable formula or to make useful generalizations. Our ultimate concern, however, is with individuals.

Further research is needed in this area to determine what the profile patterns may mean and to find a measure that predicts early and adequately the personality variables involved in later success.

Microfilm $2.00; Xerox $4.80. 93 pages.

THE EFFECTS OF A SPECIAL PROGRAM OF TEACHER EDUCATION AND SUPERVISION UPON JOB SATISFACTION OF VOCATIONAL AGRICULTURE INSTRUCTORS OF PUERTO RICO

(L. C. Card No. Mic 59-2910)

Juan Robles, Ed.D.
The Pennsulvania State University, 1959

For a number of years the Department of Education of Puerto Rico has been unable to recruit and retain as many suitable persons as needed to teach vocational agriculture. College of Agriculture graduates have manifested preference for other types of work. It was considered that job satisfaction might be an important factor. The study was made to discover relationships between selected factors and job satisfaction and to investigate the effects of a special program of teacher education and supervision.

Three null hypotheses were tested at the 5 per cent level. The first stated that certain factors related to the job, to the individuals and to the living and working environment were not significantly associated with job satisfaction. The second hypothesis was that there is no significant relation between job satisfaction and the opportunity of the teacher to find in the job things cherished by him in life. The third hypothesis was that there is no significant difference in job satisfaction between an experimental group of teachers who participated in a special program of teacher education and supervision and a control group of teachers who did not receive the special program, as measured by the teacher scores on the Hoppock job satisfaction scale and by scores of community leaders on a scale of community acceptance of the program.

A survey phase of the study to test the first two hypotheses involved the 98 teachers who were in service at the beginning of the 1957-1958 school year. An interview schedule was used with each teacher and the Hoppock and Moore job satisfaction scales were administered.

The groups in the experimental phase were 20 teachers of the Mayaguez district and an equal number randomly selected from the other supervisory areas. Scores for community acceptance of the program were obtained from five leaders of each of the 40 communities. The school principal was one of the leaders. The special program conducted with the teachers of the Mayaguez district included supervisory visits and six monthly meetings. These activities were aimed at the improvement of the teachers as individuals. The control group attended meetings in which routine matters concerning administrative affairs were presented. The supervisory visits made were consistent with the two types of meetings. The teachers and leaders in the experimental and control schools were post-tested.

The general survey of the 98 teachers showed seven specific factors to be significantly associated with job satisfaction. The factors were: salary, years of teaching experience, type of contract, farming opportunities in the communities, organization of classes for young and adult farmers, technical preparation and condition of roads. Positive correlations were found for the first five factors. In the case of the last two factors, it was the teachers with the lowest technical preparation and those in communities having roads in fair condition who had the highest job satisfaction scores.

The high correlation of 0.904 between the total scores on the Moore scale and the Hoppock scale indicated that there is a significant relation between the opportunity of the individual to experience in the job things cherished by him in life and job satisfaction. Significant correlations were also found with each of the four subdivisions of the Moore scale: relationships with people, intrapersonal feelings, working conditions and community and environmental conditions.

The teachers in the experimental group that participated in the special program showed a significant job satisfaction mean score increase of 3.45 points on the post-test. The change was only 0.20 for the control group. The community acceptance mean score of the leaders in the experimental group of schools had a significant increase of 2.80 points as compared with 0.05 points for the control group.

The results of the experiment indicated that, as judged by the increase in the Hoppock job satisfaction mean score of the teachers and in the community acceptance mean score of the leaders of the experimental schools, job satisfaction was significantly improved by the special program of teacher education and supervision.

Microfilm $2.00; Xerox $5.80. 117 pages.

A COMPARATIVE STUDY IN READING PROGRESS OF TWO GROUPS OF MENTALLY RETARDED ADOLESCENTS SUBJECTED TO DIFFERENTIAL READING MATERIALS: A COMPARISON OF THE EFFECTIVENESS OF TEACHER-PREPARED VERSUS PUBLISHED READING MATERIALS

(L. C. Card No. Mic 59-1941)

Louis Scharf, Ed.D.
New York University, 1959

Chairman: Professor Brian E. Tomlinson

This study undertook to evaluate the comparative effectiveness of teacher-prepared reading materials with published reading materials in furthering the reading progress of mentally retarded adolescent boys.

The basic hypotheses were that this study would reveal measurable differences in reading progress between the two groups that participated in the experiment, and the the group taught through teacher-prepared materials would gain significantly more in reading progress than the group taught through published reading materials.

Two groups of retarded adolescent boys were equated, using these characteristics: chronological ages, intelligence quotients, mental ages, and reading grades. All attended junior high school classes. They came from below average socio-economic backgrounds. They were typical pupils found in such classes. Each group started with eighteen pupils.

The participating teachers were equated in terms of sex, age, academic degrees, teaching experience, special training, preference for reading materials, and principals' ratings of their teaching effectiveness.

The experiment was started during October, 1955, and continued through the first week of June, 1956. Reading was taught daily for one period of one hour.

Three instruments were used to evaluate the status of the pupils at the beginning and at the conclusion of the experiment. These instruments were the Metropolitan Achievement Test, a functional vocabulary test, and a check list with an appropriate rating scale. The co-teaching colleagues of the participating teachers independently used the same check list to rate the pupils at the end of the experiment. These ratings were used as controls.

The results obtained from the achievement tests for Group I, at the start and end of the experiment, failed to show statistically significant progress in reading ability. The functional vocabulary test results for both word recognition and word meaning showed that Group I's progress was statistically significant at the 1 per cent level. This was likewise true for the work-study skills measured by the check list. In independence in reading the check list results indicated progress significant at the 2 per cent level. No difference statistically significant existed between the check list ratings of the participating teacher and his colleague.

The achievement test results showed that Group II's progress was significant at the 2 per cent level. This was also true for growth in word recognition measured by the functional vocabulary test. Group II's growth in work-study skills was significant at the 1 per cent level. No significant progress was made in word meaning and in independence in reading. No significant difference in check list ratings existed between the participating teacher and his colleague.

A comparison of the means of the evaluative instruments' results attained by Groups I and II at the end of the experiment showed differences statistically significant in favor of Group I at the 5 per cent level only in word recognition and in independence in reading.

In view of these findings and conclusions it was recommended:

1. That the superior value of teacher-prepared reading materials rests essentially in helping retarded adolescent boys in mastering the functional vocabulary related to teaching the curricular core areas.
2. That both teacher-prepared and published reading materials should be used in the teaching of developmental reading to mentally retarded adolescents.
3. That a vital need exists for appraisal instruments which will validly and reliably measure reading progress of mentally retarded children.
4. That only a reasonable equating may be achieved in teaching effectiveness and teaching procedures.
5. That changes in the social, emotional, attendance, physical, and behavior status of pupils during an experiment may influence the conclusions.
6. That future comparable experiments may undertake a three group approach. The third group would be taught reading through the equal use of teacher-prepared and published reading materials.

Microfilm $2.20; Xerox $7.60. 165 pages.

AN EVALUATION OF THE EFFECTIVENESS OF TWO METHODS OF INSTRUCTION IN TEACHER EDUCATION

(L. C. Card No. Mic 59-2750)

Emily Bell Schuh, Ph.D.
The Ohio State University, 1959

The primary purpose of this investigation was to discover the effectiveness of two methodological procedures in producing certain verbal and operational outcomes in two student groups. A secondary purpose was to discover the effectiveness of two teaching methods in terms of expected performance and student preference.

During the Winter Quarter of 1958, seventy-seven prospective elementary teachers were enrolled in two sections of a professional course intended to develop teaching competency in the area of social education. The two groups were not significantly different when estimated intelligence, achievement, teacher attitudes, and pre-test scores were equated. One section was taught by the unit approach, emphasizing the directness of experience. The other section was taught by more conventional classroom procedures. Unit teaching competencies were established as the educational objectives of instruction and served as the basis for appraising verbal and operational performance of the students. Verbal performance was measured by a pre- and post-test situational test. Operational evidence was gathered through observation in a student teaching follow-through of twenty-two students during the Spring Quarter of 1958. The college supervisor, cooperating teacher, student, and in some cases the investigator evaluated on a rating scale the student's classroom unit teaching competence. Student opinions in both sections were sought in an effort to establish the frequency of certain instructional procedures (Student Analysis Form) and instructional effectiveness (Student Reactionnaire Form). The student analysis, along with preplanning and anecdotal materials, was used to substantiate the premise that a marked difference existed in the instructional activities of the two sections.

This study tended to reveal that the two methodological procedures used produced similar verbal and operational outcomes. This judgment is supported by the following data:

1. Each group made significant mean gains in achievement as measured by the pre- and post-test. Yet the difference between group gains was not significant.
2. A correlation of .090 between post-test score and group membership would imply that group membership had extremely little relationship to verbal performance.
3. No significant group differences were discernible in operational performance as judged by the college

supervisor, cooperating teacher, student self-evaluation, and investigator.

A correlation of .645 between post-test performance and cumulative point hour or expected performance was used as an index of course effectiveness. The students reacted favorably to both methods of instruction but the unit approach enjoyed a slightly superior student rating. Further research might explore instructional procedures designed to achieve operational behaviors and to increase the level of transfer from professional courses to professional experience.

Microfilm $3.40; Xerox $12.60. 290 pages.

A DOCUMENTARY FILM ON THE INSTITUTE OF LOGOPEDICS

(L. C. Card No. Mic 59-2502)

James Sawyer Vaughan, Ed.D.
The University of Texas, 1959

Supervisor: B. F. Holland

The purpose of this study was to plan and produce a motion picture film dealing with rehabilitation problems of speech-handicapped children and adults. The approach was made through a documentation of the clinical and professional training programs in progress at the Institute of Logopedics, a major rehabilitation center, located at Wichita, Kansas.

The general purposes of the film are: (1) to acquaint professional and lay groups with the program of rehabilitation in progress at the Institute of Logopedics, and (2) to emphasize the need for trained persons in the field of speech correction. Specific purposes of the film are: (1) to emphasize the importance of corrective training for speech-handicapped persons, (2) to enumerate the multiple causes and general types of speech defects, (3) to illustrate corrective practices, and (4) to indicate the opportunities for professional training available at the Institute of Logopedics.

The anticipated audience includes: (1) professional and lay groups interested in the rehabilitation of the speech-handicapped, and (2) prospective students in the field of speech correction.

Introductory scenes depict the seriousness of speech impairment on the personal and social adjustment of a child. The narration indicates that less than 10 per cent of those with speech defects, or defects of hearing, with which speech disorders are associated, receive proper training. Other scenes indicate briefly the history of the Institute and the scope of its operations.

Examining and testing procedures are shown with special reference to: (1) psychological testing, (2) educational testing, and (3) specialized forms of testing for hearing and speech.

A sequence devoted to individual language and speech rehabilitation deals with the causes and general types of speech defects. Organic, functional, and psychogenic disorders are shown to result in (1) defects of articulation, (2) defects of voice, (3) defects of rhythm, (4) delayed speech development, (5) cleft palate speech, (6) cerebral palsied speech, (7) impairment of previqusly developed language function (aphasias), and (8) speech defects associated with defective hearing. The technique used in diagnosis and treatment is illustrated.

Orthopedic cases are shown as they receive special training in the physical therapy program at the Institute. Other scenes show how children receive training in basic self-care skills as they carry newly acquired language into a schedule of occupational therapy.

Classroom procedures are described as they pertain to preschool, primary, and intermediate age groups of children. The professional training program at the Institute is depicted, with special attention on the observational and research aspects of the program.

Microfilm $2.00; Xerox $3.00. 39 pages.

EDUCATION, THEORY AND PRACTICE

CLASSIFICATION INTO COLLEGE MAJOR-AREAS OF CONCENTRATION BY MEANS OF MULTIPLE DISCRIMINANT FUNCTION WEIGHTING OF COLLEGE ENTRANCE TEST SCORES

(L. C. Card No. Mic 58-5107)

Charles D. Baker, Ed.D.
University of Kansas, 1957

In this study, males in five major-areas of Business Administration, Education, Industrial Arts, Physical Education, and Social Science were used as criterion groups for the development of the four systems of weighting, and for separate cross-validation groups. The criterion for group membership was at least junior-year satisfactory standing in one of the five major-areas.

An added feature in the study was the investigation of success of classification resulting from each of the eleven possible combinations of the four weighting systems resulting from this five-group case use of the multiple discriminant function.

The entrance test data variables included were:

1) ACE-Linguistic score,
2) Cooperative Reading Comprehension Vocabulary and Speed scaled scores, and
3) Kuder Preference Record--Vocational, Form B, (or corresponding scores from Form C), all scores except Scientific.

Other scores from these tests were not included either because of overlap with included scores, or because the means and standard deviations of the score distributions for the different major-area groups were apparently not sufficiently different for there to be discrimination between the groups.

In the process of developing the characteristic equation, difficulty was experienced in loss of significant digits in the development of the computational matrices. This problem was appreciably reduced following rearrangement

of variables in inverse order of maximum intercorrelation with other variables.

The criterion for estimating the number of the roots and associated systems of weights, or dimensions, necessary to account for the major share of the variance in this case indicated that use of at least three roots would be needed to provide satisfactory discrimination. However, success of the classification resulting from use of the first two roots was not significantly less than the best combination of three roots, or than the ultimate combination of all four of the roots.

Success of classification approximated 50%, as opposed to chance expectancy of 20% for five groups. This level of success held true both when:

1) individuals were first sub-grouped by their own choices, and then discriminant classification was compared; and,

2) multiple discriminant function classification of the individuals was done first, and then actual major-area choices by the individuals were compared.

Although success of classification was appreciable, one impression was that a two-stage classification system might have provided even greater success. In this case, the amount of overlap of three of the five groups (Education, Physical Education, and Social Science) was very pronounced in most of the original test data variables, and in the subsequent root "dimensions". If these three closely similar groups had been pooled into a composite group, making a three-group case for the first stage, and then there had been a second stage of separation of the composite into its components, success might have been improved. It also seems likely that the computation involved in two such three-group cases would have much less than was found necessary in a single five-group case.

This study would seem to accentuate the need for the development of criteria for choice of variables for use in such studies, and for the arrangement of chosen variables within the computational processes of such studies. Other needed developments would seem to include further study of effectiveness of variables of the types used here, as well as investigation of utility of other types of quantifiable data about individuals, of success of classification using other criteria for success of classification, and of longer range from predictors to predicted.

Microfilm $3.50; Xerox $11.80. 269 pages.

THE DILEMMA OF RELIGION IN PUBLIC EDUCATION

(L. C. Card No. Mic 59-2574)

Jack Joseph Cohen, Ph.D.
Columbia University, 1959

The dissertation attempts to provide a theoretical basis on which to resolve the dilemma which faces American educators as a result of their adherence to the principle of separation of Church and state and the ideal of free inquiry. The separation principle has up to now precluded more than a peripheral treatment of religion in public education, while free inquiry seems to call for as thorough a handling of the subject as educational soundness requires.

The main point in the suggested theory is that the study of religion in the American public school has to be grounded in the exploration of the religious qualities that inhere in the common historical experience of all Americans.

The dissertation first considers the principle of religious pluralism in the United States. Pluralism is not to be understood as the tolerance by the Christian majority of non-Christian religions. Rather, it is the assumption that unity in a democratic society should and can be established in both theory and practice without religious uniformity. It is both historically false and democratically imprudent to speak of the United States as a Christian country.

Various interpretations of the bearing of religion on American democratic polity are critically examined. It is shown further why American polity cannot be viewed as Christian, why it cannot be founded on religious supernaturalism and why, on the other hand, its religious quality should be accorded recognition. That quality has to be understood in the context of the First Amendment.

Against this background, the dissertation goes on to explore several positions on the role of religion in public education. Wherever possible, statements of official church bodies are analyzed, but attention is also given to the views of influential thinkers. A defense is entered against the prevalent attack by many religionists on the public school as espousing an anti-religious secularism.

Then follow a description and a critical analysis of several plans for the teaching of religion in the public school. The released time plan is first treated because of its involvement with certain conceptions of the role of religion in a pluralistic society. The remainder of this chapter, however, is concerned with blueprints of curricular construction in the area of religion, including the objective, factual study of religion, teaching moral and spiritual values, and teaching a common core. Two widely publicized proposals, the so-called Kentucky plan and the Character Research project, are considered.

After rejecting these proposals in part or in whole, the argument returns to consider whether or not there is a common American religion on which the teaching of religion might be based. The theories of Moehlman, Herberg, Kouwenhoven, Vogt, H. R. Niebuhr, Williams and Kaplan are analyzed as a prelude to the author's presentation of his own view. Democratic education requires that American civilization be explored in all its facets, in order that students be free to elicit its universal values and in order, too, that they be trained to enhance its universal quality by their own criticism. This enterprise is identified as religious in character and as being fully in accord with democratic institutions.

In the last chapter, it is shown, through reference to proposals by Madden and Phenix, how religion can be legitimately studied through the study of American civilization and through the treatment of religion as concern for the qualitative development of human personality.

Careful reservations as to the immediate application of the foregoing theory are made at several points. It is held that the problem of religion in public education should be handled in a spirit of gradualism. In such a spirit, the point of view set forth can serve as a valuable critical tool for men and women who daily have to handle the issue.

Microfilm $4.05; Xerox $13.60. 314 pages.

A STUDY OF LAY PARTICIPATION IN CURRICULUM DEVELOPMENT IN SELECTED SCHOOLS

(L. C. Card No. Mic 59-2557)

James Lewis Dickerson, Ph.D.
The Ohio State University, 1954

Purposes of the Study

The purposes of the study were to investigate the opportunities which lay citizens have had to participate in curriculum development programs in selected elementary and secondary schools; the extent to which laymen have accepted the opportunities to take part; the channels through which laymen have participated; the specific areas of curriculum planning in which lay citizens have been involved; the activities in which laymen have been engaged; the values that have been derived by both laymen and the schools from participation; and the procedures that have been followed. The basic investigation involved a study of lay citizen participation in a group of thirty-eight selected schools in the state of Georgia. The study was concerned with lay participation in curriculum improvement for a class, a school, an entire school system, or some combination of these.

Procedures and Sources of Data

From the pertinent literature and from his personal point of view the writer derived a set of principles for guiding lay participation in curriculum development programs. From these principles criteria were derived for evaluating lay citizen participation in the selected schools. In this way the prevailing practices could be evaluated in terms of practices that are considered desirable.

Accompanied by a mimeographed form, letters announcing the study were sent to the instructional supervisors in the state. They were invited to give the names of superintendents, principals, and teachers whom they knew had involved laymen in curriculum planning sometime during the years 1952 and 1953. The supervisors were asked to indicate whether they had engaged laymen in planning programs, and whether they would be willing to cooperate with the study. The investigator also communicated with superintendents, principals, state department of education officials, and educators engaged in teacher education in an effort to locate other school personnel in the state who had worked with laymen in curriculum development activities. The names of approximately 100 principals and superintendents were suggested by these sources.

A letter of invitation to participate in the study was then sent to each principal and superintendent whose name had been suggested. Each of them was asked to furnish the names of teachers in their respective schools who had worked with parents in curriculum development on a class basis. They were also asked to supply the names and addresses of lay citizens in their communities who had taken an active part in curriculum planning. Replies were received from 84 of the principals and superintendents. Seventy-one of these reported that they had worked with laymen in curriculum planning and would be willing to cooperate with the study. From the schools of this group 38 schools were selected. They were representative of schools in the state and in neighboring states.

Questionnaires and interviews were used in collecting data for the study. Three sets of questionnaires were devised. One set was administered to laymen, another to teachers, and a third to administrators and supervisors. The questionnaires secured data from each of the above groups about such items as: opportunities for lay citizens to participate; estimated percentage that had actually participated; reasons for participation; channels through which participation took place; what laymen did when they were involved; effect of participation on the obstacles to curriculum improvement; specific areas of curriculum development with which laymen had assisted; procedures that were followed; and the values of participation to both the lay citizens and the schools.

Another important source of data was the interviews with selected laymen, teachers, administrators and supervisors in a sampling of the schools. Check sheets were used in recording interview data. The structured part of the interviews dealt with aspects of lay participation similar to those dealt with in the questionnaires. In addition, interviewees were encouraged to comment about the values and possible dangers of involving lay citizens in curriculum development programs.

The following criteria derived from the set of principles formulated in the study were used in evaluating the data obtained through the interviews and the questionnaires:

Criteria for Evaluating Lay Participation in General Aspects of Curriculum Development

1. Have lay citizens who were affected by changes in the curriculum had opportunities to assist with the planning?
2. Have laymen assumed responsibility for taking part in curriculum study and planning on class, school, and school system bases?
3. Have laymen participated because they were interested in improving the educational opportunities for children and youth?
4. Have laymen had policies to help guide them in curriculum planning when they worked in groups?
5. Were policies set up cooperatively by laymen and school staff members?
6. Did policies help the participants to do a more effective job of planning?
7. Has lay participation in group planning been centered around problems of common interest that were discovered through a study of the school program?
8. Have lay groups had access to appropriate channels through which they could approach curriculum problems that were of common concern to members of the group?
9. Has the use of leading questions in group discussions been an effective means of helping laymen to think through and arrive at solutions to curriculum problems that were of common concern?
10. Have laymen approached curriculum problems of an individual nature through parent-teacher and parent-administrator conferences?

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11. Have curriculum changes been based on a consideration of the latest research findings?
12. Have lay citizens participated because they were invited and encouraged to do so by members of the school staff?
13. Has lay participation brought about a better understanding of the school program?
14. Has lay participation improved community support of the school program?
15. Have there been obstacles to curriculum improvement in the school-community relationships?
16. Has lay participation tended to remove or reduce in influence the existing obstacles to curriculum improvement?
17. Have laymen become more interested in seeing the school receive adequate financial support when they have had a part in curriculum planning?

Criteria for Evaluating Lay Citizen Participation in Certain Specific Areas of Curriculum Development

1. Have laymen helped to determine the goals or purposes of the school?
2. Have laymen helped to re-examine and revise the goals of the school?
3. Have laymen studied the goals of the school?
4. Have laymen helped to identify the needs of children and youth as the basis for curriculum planning?
5. Has participation helped laymen to develop a better understanding of the needs of children and youth?
6. Have laymen had a more favorable attitude toward curriculum changes when they have studied the needs of children and youth?
7. Have lay citizens of the community who have special abilities and skills served as resource persons to help vitalize the school program?
8. Have lay citizens helped to evaluate the school program?
9. Have judgments of laymen been used in evaluating describable behavior of children and youth in school and of graduates and drop-outs?
10. Have laymen evaluated their participation in curriculum development as groups and as individuals?

Summary of Findings

The findings of the basic investigation were obtained through 88 interviews with 107 selected individuals, and the return of 483 questionnaires from 257 laymen, 142 teachers, and 84 administrators and supervisors. The lay citizens who had participated in curriculum development represented 53 different occupations. While most of them had children in school, over 10 per cent of those who participated had no children in school.

The school personnel in most of the schools involved in the study had assumed leadership responsibilities for engaging laymen in planning programs. Over two-thirds of the school staff respondents reported that they had received special preparation of some kind for working with laymen. Most of them had less than ten years of experience in doing this type of planning.

One hundred per cent of the laymen interviewed, and 95 per cent of those who returned questionnaires had participated during the years 1952 and 1953. They were engaged on a school and class basis more than they were on a system-wide basis. Although nearly all of the interviewees and respondents were of the opinion that laymen should participate, in some instances the number who had actually done so was relatively small.

Laymen reported that they had assisted with curriculum planning chiefly because they were interested in improving the educational opportunities for children and youth. More of them became interested in participating because they were invited and encouraged by school personnel than through any other means. In most instances participation was centered around problems of common interest that were discovered through a study of the school program. Citizens approached their common problems primarily through such means as parent-teacher association meetings, community planning meetings, parent-study groups, grade-parent meetings, curriculum committees, citizen committees, and school surveys. They also rendered assistance through such community organizations as farm groups, civic clubs, women's organizations, business groups, religious organizations, city councils, and veterans' organizations. Lay citizens had usually approached curriculum problems of an individual nature through parent-teacher, parent-administrator, or some other type of informal conferences.

The findings show that laymen had participated in specific areas of curriculum development in most of the schools by helping to determine the goals or purposes of their schools, identify the ascertainable needs of children and youth as a basis for teacher-pupil planning of learning activities, vitalize school programs as resource persons, and evaluate their school programs. They had assisted with these particular areas in many different ways as indicated by the study.

The interviewees and respondents reported that certain procedures had contributed a great deal toward successful participation. For example, over two-thirds of the respondents reported that lay groups in their respective communities had policies or agreements to give them guidance in planning. The policies were determined cooperatively by laymen and school staff members in well over 50 per cent of the schools. Policies had aided laymen by establishing the channels of authority, responsibilities incumbent upon them, and their relationships to the school staff, the board of education, and the community.

The study revealed several weaknesses in programs of lay participation in some of the schools. Only about one-half of the schools had plans for evaluating lay participation as groups and as individuals. Less than 43 per cent of the lay respondents had made any attempt to evaluate their individual participation. Comments made by interviewees revealed certain weaknesses in the plans used. Changes were made in curricula in nearly a fourth of the schools without considering the latest research findings concerning the proposed changes. Only 60 per cent of the teachers participating in the study had secured and used the judgments of parents in evaluating pupil-progress of children and youth in their homeroom groups or classes.

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The study indicated many values that were derived from participation by both the lay citizens and the schools. The following are a few examples:

1. Laymen learned more about their school programs through participation
2. Some of the obstacles to curriculum improvement were gradually removed or reduced in influence as the result of participation
3. Laymen developed more favorable attitudes toward curriculum changes when they studied child growth and development
4. Laymen became more interested in the financial support of their schools
5. School staff members received valuable suggestions and ideas for improving school programs
6. School-community relationships were improved
7. Laymen learned how to plan and work with others more effectively in group situations
8. Laymen were made aware of the conditions within their schools
9. School programs were expanded and improved
10. Attitudes of laymen toward their schools and the teaching profession were improved
11. Attitudes among pupils and between pupils and teachers were improved
12. New resource persons for vitalizing school programs were discovered

Conclusions

The findings of this study led to the following major conclusions:

1. There are significant values that can be derived from participation by both the lay citizens and the schools. Participation can help improve school-community relationships, remove or reduce in influence some of the obstacles to curriculum improvement, secure valuable ideas from laymen for improving curricula, prepare laymen for accepting changes, provide valuable educational experiences for adults, acquaint parents with research findings concerning child growth and development and the psychology of learning, develop a better understanding of the school program, and bring about increased moral and financial support for schools.
2. Lay citizens can make valuable contributions to certain areas of the school program. They can help determine the goals or purposes of their schools, identify the ascertainable needs of children and youth as a basis for curriculum planning, vitalize the school program when they have special abilities and skills that are needed, evaluate the results of the school program, and secure adequate finances with which to make improvements.
3. Laymen will work together more effectively in curriculum planning when they follow certain procedures that have been agreed upon by the group.
4. Laymen usually depend on professional school personnel for leadership in curriculum planning. This means that school personnel should have adequate professional preparation for providing the necessary leadership.
5. Lay citizens can assist with curriculum development responsibilities on class, school, and school system bases. They seem to be more interested in participating on a class or school basis where their children are enrolled, than on a system-wide basis which is somewhat remote to their immediate interests.
6. Although there are many values to be derived from participation, there are also some possible dangers. The dangers of unsatisfactory participation must be guarded against insofar as possible. In spite of the possible dangers, lay participation offers one of the most promising means of giving increased impetus to curriculum study and improvement.

Recommendations

To the Schools that Participated in the Study

The following recommendations are suggested for improving lay participation:

1. Professionally prepared school personnel should exercise the initiative and status leadership for involving lay citizens in curriculum development programs.
2. School personnel should develop readiness among laymen preparatory to engaging them in planning programs.
3. The opportunities for lay participation should be expanded in the schools as the state of readiness by both the laymen and the school personnel will permit.
4. A larger percentage of the lay public and the school staff should be encouraged to take part in the opportunities that are now available.
5. Greater emphasis should be placed on working with parents in curriculum study and planning on a class and school basis.
6. Lay citizens should be encouraged to help determine the goals of their schools, identify the ascertainable needs of children and youth, vitalize school programs as resource persons, evaluate the results of the school program, and secure adequate finances for making improvements.
7. Agreements should be established cooperatively by laymen and school staff members regarding policies and procedures to be followed in their programs of lay participation.
8. School staff members who involve lay citizens in any phase of curriculum development should see that adequate plans are provided for them to evaluate their participation as groups and as individuals.
9. The status leader should help lay citizens center their participation around curriculum problems of common interest that are discovered through a study of the school program.

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10. Changes made in the curriculum should be based on a consideration of the latest research findings.
11. Parent-teacher and parent-administrator conferences should be encouraged as a means of approaching curriculum problems that are of an individual nature.

To Teacher Education Institutions

1. Adequate provisions should be made in pre-service teacher education programs for developing the competencies needed for working with laymen in curriculum development programs.
2. Provisions should be made in teacher education programs for helping in-service school personnel to learn how to work effectively with lay citizens in curriculum study and planning.

To the State Department of Education

1. The public school personnel in the state should be encouraged to make wider use of the services of lay citizens in programs of curriculum improvement.
2. The State Department of Education should assist the teacher education institutions in planning adequate pre-service and in-service programs for preparing school personnel to work with lay citizens in curriculum development.

Regarding Further Research That Is Needed

The study has revealed a need for further research in regard to:

1. The impetus which has been given to curriculum improvement in the state as the result of lay citizen participation
2. The extent to which the judgments of laymen are used in evaluating the progress of children and youth in school, and of graduates and drop-outs
3. The nature of the evaluations which laymen make of their participation as groups and as individuals
4. The procedures used by school staff members in working with laymen in curriculum development

Microfilm $5.05; Xerox $16.80. 393 pages.

Abstract published by special arrangement with The Ohio State University.

A STUDY OF CERTAIN SELECTED VARIABLES, THEIR RELATIONSHIP TO RATE OF READING AND THE EFFECT OF THE RELATIONSHIPS UPON THE IMPROVEMENT IN READING RATE DUE TO TRAINING

(Publication No. 20,822)

Gerald G. Glass, Ph.D.
Syracuse University, 1957

Supervisor: William D. Sheldon

Statement of the Problem

Reading is a crucial skill which affects all people. One factor of Reading, the rate at which one comprehends written material, may be a determinant of success in reading. A retarded Reading Rate may affect the amount that one will read as well as what is learned from the material. It may also set negative attitudes toward reading for all purposes.

This study attempted to determine the magnitude of the relationship between Reading Rate and seven selected variables which were deemed potential correlates. The variables include: Rate of Perception, Vocabulary, Compulsiveness, Drive, Speed of Closure, Flexibility of Closure, and Grade Point Average. In addition, an hypothesis relative to improvement in Reading Rate due to training was derived. It stated that improvement will be a function of individually determined attributes taken in relation to actual performance in Reading Rate. The determined attributes are those found empirically to be associated with faster readers.

Procedure

Students taking Psychology courses in the Liberal Arts College of Syracuse University were used as subjects. Data relating to the magnitude of the relationship between the selected variables and Reading Rate were reported mainly in terms of Pearson Product Moment Correlations and Partial Correlations. The N for these parameters was 208.

An "Expected Score" was computed based upon a multiple correlation coefficient for rate of reading. The correlations for the regression equation were taken from those reported on 130 of the subjects. Thirty-four other subjects were chosen for two groups to be trained in Reading Rate. One group (Minus) consisted of individuals whose actual rate score was lower than what was expected (predicted) based upon their scores on the three predictor variables: Rate of Perception, Vocabulary, and Compulsiveness. The other group (Plus) had discrepancy scores indicating that they were reading above their Expected Score. Both groups received a one-month, three-times-a-week, 20-minute session course to increase rate of reading. No mechanical devices were utilized. The subjects did key word and phrasing exercises and read articles of interest. It was hypothesized that the group reading below expectancy would improve more than those reading at or above expectancy. Each experimental group (Plus and Minus) was matched with a control group on size, mean initial rate, variance, and size and direction of discrepancy.

Main Results and Conclusions

The following are the correlations found between the variables and Reading Rate. The closure factors are significant at the .05 level of confidence. Drive is not significantly related. All others are significant at the .01 level of confidence: Rate of Perception, .497; Vocabulary, .398; Compulsiveness, -.355; Grade Point Average, .184; Speed of Closure, .143; Flexibility of Closure, .150; Drive, .106. Partial correlations suggest that partialing out any of the variables resulted in negligible changes in the product-moment correlations. The closure factors were tested for sex differences. They showed that a relationship exists between rate and the closure factors for females whereas none exists for males.

None of the relationships found is of such a magnitude as to suggest that when one is high or low in one of the variables he will most likely be high or low in Reading Rate. But implications are that the variables do play some role in Reading Rate.

The results of the experiment done to predict difference in improvement in Reading Rate support the hypothesis that the Minus group would improve more than the Plus group. The difference was significant at the .02 level of confidence. The implications are that the three predictor variables do play a role in determining the amount of improvement made by the experimental over the control group. Although the results indicate that all may not have the same potential to improve, the difference in improvement between the two experimental groups was not sufficient to warrant the screening of individuals on the variables utilized before acceptance into a Reading Rate program.

Microfilm $2.55; Xerox $8.80. 195 pages. Mic 59-2974.

A STUDY IN CHANGE OF ATTITUDE OF STUDENTS PARTICIPATING IN A COMBINED SEMINAR-LABORATORY IN CHILD DEVELOPMENT: AN ACTION-RESEARCH PROJECT

(L. C. Card No. Mic 59-1908)

Emily Belle Higgins, Ed.D.
University of Maryland, 1958

Supervisor: Professor Daniel A. Prescott

Purpose

The purpose of this study was to measure change in attitudes of acceptance in pre-professional education students participating in a seminar-laboratory course in Child Development. Effort was made to learn whether the needed changes were toward more acceptance of themselves and of others and whether the change of attitude depended upon change toward more acceptance of human development concepts.

Procedure

The information used in this study was collected at the beginning and ending of an academic year in a small liberal arts college. Two groups of females in their junior year were used for the experiment, each composed of sixteen students. The experimental group was enrolled in a seminar-laboratory course in Child Development and the control group was comprised of students from fields closely related to those covered in the child development course. They were tested on a framework of human development principles.

Two general hypotheses, each having two sub-hypotheses formed the basis of this experiment. Hypothesis I dealt with change in attitude toward acceptance of self and others. The first sub-hypothesis predicted that there would be a change in attitude toward more acceptance of aggressive behavior in young children. The second sub-hypothesis postulated that there would be a change in attitude toward more acceptance of others as a result of more acceptance of self. Hypothesis II stated that there would be a movement toward more acceptance of child development concepts. Sub-hypothesis a under this prediction was concerned with change in attitude toward more acceptance of the idea that growth and development play a dominant role in the behavior of children. Sub-hypothesis b predicted a movement toward more acceptance of the concept that all behavior is an expression of inner needs emerging from the inter-active forces of a physiological, sociological and psychological organism.

Four measuring techniques were employed for testing the students on the above hypotheses. In measuring change in attitude toward more acceptance of self, part of The Index of Adjustment by Bills, Vance, and McLean was used. Change in attitude for sub-hypothesis a was determined by the results of The Minnesota Teacher Attitude Inventory. Sub-hypothesis b was measured by a Self-Insight Scale invented by Dr. Lewellyn Gross. The Stanger Attitude Scale was used in denoting change in attitude for general hypothesis II and for both sub-hypotheses. Results of the tests were calculated by the "difference method" to obtain the t score at the critical level of significance at .01 on the Student Distribution Table.

Finding

In general the findings did not support the two general hypotheses and were not significant in any of the sub-hypotheses. However, the Stanger Attitude Scale seemed to be a more sensitive instrument and showed some trend toward a more accepting attitude in general hypothesis II, from the initial test in the fall to the final test at the end of the term. Both sub-hypotheses gave the same indication of change in attitude but were not significant at the .01 critical level. The experimental group did show a somewhat greater trend toward more acceptance of the concept that behavior is an expression of inner needs than did the control group, which may indicate some factors in operation not considered in this experiment.

Microfilm $2.00; Xerox $5.20. 105 pages.

TEACHING METHODS AND ACTIVITIES USED BY SOCIAL STUDIES TEACHERS RATED AS SUPERIOR BY THEIR ADMINISTRATORS

(L. C. Card No. Mic 59-1882)

John Elton Lux, Ed.D.
The University of Nebraska Teachers College, 1959

Adviser: J. Galen Saylor

Statement of the Problem.

The purpose of the study is to determine the types and extent of teaching methods and activities being used by superior social studies teachers in selected Nebraska secondary schools.

Procedures.

The administrator of each secondary school with an enrollment of over 150 pupils was asked to name outstanding and superior social studies teachers in his school. A questionnaire on methods and activities was mailed to the 146 teachers so designated, and data from 114 teachers were used. Personal interviews with 55 superior teachers were conducted to provide more specific information on the effective use of various methods.

Findings.

The principal conclusions of this study are:

1. A wide variety of methods and activities were used in teaching social studies.
2. The manner and extent to which different methods were used varied widely, depending upon the teacher, the students, and the specific learning situation.
3. Activities were used as an integral part of the social studies program for maximum achievement rather than as a substitute for minimum requirements.
4. Student participation in the planning and the conduct of different activities was emphasized.
5. A definite preference for the unit plan of organization, the teacher-led discussion type of presentation, and the discussion of current events one-day-a-week was shown.
6. The basic approach to the study of social studies subjects varies with the subject taught.
7. Group activities are not used extensively by many of the superior social studies teachers. Many of these activities, however, were used in a limited but comprehensive way and were listed as "most worthwhile and successful" projects.
8. Individual activities were used quite extensively, especially outside readings and oral reports.
9. The audio-visual activities used most frequently were films, bulletin board displays, map exercises, and pictures.
10. Objective examinations and essay questions were the evaluative activities most widely-used.
11. Comparisons between the methods and activities used by junior and senior high school teachers show that debates, surveys, lectures, research papers, essay questions, daily quizzes, and the discussion of current events one-day-a-week were used more extensively by senior high school teachers while dramatizations, the making of charts and maps, bulletin board displays, filmstrips, pictures, and supplementary textbooks were used more extensively by junior high school teachers.
12. The methods used to achieve different social studies objectives emphasized active participation and specific materials.

Recommendations.

The following recommendations were made:

1. There is a great need for additional research in this area.
2. More extensive use of the problems approach should be encouraged.
3. Teachers should be encouraged to make wider use of group activities.
4. Student participation in different activities should be continually stressed.
5. A wide variety of materials should be available for use.
6. The preparation of prospective social studies teachers should include (a) a thorough knowledge of the methods and activities used by superior teachers and the procedures they suggested for their effective use, (b) experience in the use of many of these methods and activities, and (c) an opportunity to observe and visit with a number of superior teachers.
7. Provisions should be made for the widespread exchange of ideas on methods and activities being used effectively by social studies teachers.

Microfilm $3.35; Xerox $11.40. 257 pages.

THE POTENTIALITIES OF THE COOPERATIVE WORK-EXPERIENCE PROGRAM FOR GENERAL SECONDARY EDUCATION IN THE PHILIPPINES

(L. C. Card No. Mic 59-2563)

Dalmacio Martin, Ph.D.
The Ohio State University, 1954

The purpose of the dissertation is to determine the potentialities of the coöperative work-experience program for the reconstruction of socioeconomic life in the Philippines. Work experience is defined as a practical activity in connection with the production or distribution of goods or services in a real-life situation. It is a coöperative program in the sense that the school and the business, industrial, or civic groups join hands in making education more functional. The earning of salaries or wages by the students is implicit in this program.

In this study, the writer did three main things: (1) described in general terms the cultural or national development of the people for whom the program is intended; (2) traced the development of secondary education in the United States during the last fifty years, particularly with regard to school-work programs; and (3) outlined a plan for the gradual introduction of the program in the Philippines.

The Filipino people: their industrial and educational development.— There seems to be enough evidence to prove that much of the so-called "indolence of the Filipinos" is acquired rather than racially ingrained. Before the coming of the Spaniards it was said that the natives were well provided for through their varied agricultural activities. Misgovernment and exploitation did much to destroy the

incentive for conscientious, persevering labor. The aversion to manual labor was not so much a fault of the Filipino race as it was of the nation under which he had been a subject for three centuries.

With respect to education, it was held by Spaniards in the Philippines that education beyond the learning of the Christian doctrine was for people who had leisure or for those who did not have to work with their hands. The supreme happiness for the people, according to one Spanish writer, consisted in being completely ignorant and uneducated.

The Americans built their Philippine educational program against such a colonial influence. Against oppositions and obstacles, they pursued their program of accelerating the cultural development of the people. Work was led back to its high place in the hierarchy of values, although obviously this was no easy task. Education, on the other hand, was soon recognized as the best method for improving the entire nation from generation to generation. There was no boast of a hundred per cent efficiency in this great undertaking, but there was the strong conviction that only through education could a free people learn to manage their own affairs and solve their own problems.

Desiring to overcome the prejudice against manual labor, the early educators at the beginning of the modern period emphasized "industrial work," or activities consisting of handicrafts, shopwork, needlework, gardening, and the like. The new schools took great pride in what the hands of the little children could make for export. To cite just one type of activity in one province, the primary schools of Albay were able to deliver in 1912 one thousand salable baskets on a month's notice. Industrial work seemed to have reached a point where it was in danger of resulting in the exploitation of children.

The high school which was established in 1903 was planned to equal the best in terms of academic standards. This was to make the school attractive to the children of the wealthy and educated classes whose parents had been trained in the scholastic Spanish system. Fortunately, for a period of a quarter-century at least, there were good job opportunities for the graduates of academic high schools in the field of teaching and in various forms of government service. Vocational education in trades and agriculture was attempted early in the history of the present educational system, but any over-emphasis on it out of proportion to the economic and industrial requirements of the country was carefully guarded against. This is perhaps the reason why the high school educator has been charged with a laissez faire yielding to the path of least resistance by some critics; but he is also defended by others who say that it was this policy that kept the system from being split two ways--vocational education for the children of the workingmen and academic education for the college-bound children of the rich families. The general secondary curriculum was introduced in 1932 and carefully nurtured experimentally for almost a decade. The outcome of the trial beginnings might have been favorable to the development of a more functional, work-oriented secondary education if the war had not intervened. To be sure, there had been mistakes and uncertainties in the past educational efforts, but it was part of the new democratic faith to believe that the people would discover those mistakes, correct them, and learn from them.

The effects of the last global war on Philippine life is not hard to imagine. In 1945, conditions in Manila were indescribable. No other people in Southeast Asia suffered so much property damage as the Filipinos. The economic situation had become so menacing by 1949 that in a report to the President of the United States it was said that unless positive measures were taken to deal with the fundamental causes of the difficulties the economic situation would deteriorate further and political disorder would inevitably result. This was the time when communist-inspired bands stalked the Philippine countryside.

The program of total economic and industrial recovery was revitalized with $250 millions of mutual-security aid from the United States spread over a period of five years. The Philippine government is supplementing that amount from time to time in accordance with the terms of a bilateral agreement. This vigorous program of economic recovery could not but affect the thinking of Filipino educators. The high school is now asked more insistently than ever before to forsake its traditional partiality for the "white collar," for such a loyalty to the academic past is no longer good for the student or for Philippine society. As this is being written, the vocational education program is being strengthened in every way possible. The national government has taken over the administration of seven provincial trade schools and of ten agricultural schools the better to provide them with funds. Enrollment in vocational schools of all kinds is increasing, but 55 per cent of the total Philippine high school enrollment is still taking the bargain-counter academic curriculum of the non-public high schools; and the general curriculum of the public high schools are offering vocational courses that are, in the words of one writer, as academic as algebra or geography.

The main educational problem therefore resolves itself more or less into this situation: Work, which is assumed to be an essential part of good general education, is virtually rejected by the non-public secondary schools and is inadequately provided in the public comprehensive high schools. The few vocational schools enroll only between seven and eight per cent of the total Philippine high school youth.

Work-experience programs in the development of the American high school.—A study of educational literature during the last fifty years in the United States has revealed that leading educators have endorsed work experience as part of general secondary education.

The Smith-Hughes Act of 1917 was directed primarily at the development of vocational schools in America, but it also made provisions, through subsequent related legislations, for the extension of Federal financial assistance to the students in the comprehensive high schools taking certain part-time work programs. J. Franklin Bobbitt, in The Curriculum, and the Commission on the Reorganization of Secondary Education advocated some form of work experience for the high school.

The American Youth Commission, through its studies during and after the depression, advocated work-experience programs as a means of adapting secondary education to the vast majority of American youth. The study of 13,000 Maryland youth revealed that two-thirds of them declared economic security to be their most urgent personal need. The final 1942 report of the Commission pointed out that all youth regardless of sex need will usually profit from the experience of a job.

The war years also made work programs a means of

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

keeping youth in school while they were helping in defense jobs or in employments that were necessary in the normal conduct of civil life. The efforts of the National Association of Secondary School Principals and of the Educational Policies Commission to develop good work-study programs during the emergency seems to have paid off in the continued interest in coöperative work experience long after the hostilities were over. Designs for postwar education by the members of the John Dewey Society, the American Association of School Administrators, and Commission on Life Adjustment Education gave prominent place to work-experience programs.

Ten selected high schools in five states--Minnesota, Ohio, Indiana, New York, Pennsylvania--were visited by the writer in 1952 and in 1953. The visits supplemented the descriptions of the work programs in the educational literature; they afforded an opportunity to see the programs in action. Highlights of the observation include among others: (1) the procedures for undertaking an occupational survey, such as the 1949 survey in Connersville, Indiana; (2) the method of publicity employed in Batesville, Indiana, and Depew, New York; (3) the role of guidance and counseling services, as in Lancaster, New York; Duluth, Minnesota; and Butler, Pennsylvania; (4) the scheduling of students so that one half of the school day is spent in school and the other half in "live" jobs; (5) the concern for related instruction in all the places visited, but particularly in Troy and Van Wert, Ohio; (6) the criteria for the selection of good work stations; and (7) the emphasis everywhere that students must move progressively forward in the various phases of the job.

A study of the literature and observations of actual programs indicate agreement among educators on the following objectives:

1. To hold in school for a year longer those students who may drop out from lack of interest or lack of means
2. To provide the students with vocational exploration and guidance
3. To improve the opportunities for life adjustment of the large number of youth who have aimed at general secondary education and are not thinking of continuing in college.
4. To protect the learning status of those who are beginning to become a part of the industrial production environment
5. To help the students to avoid child-labor exploitation or unsafe employments
6. To foster the habit of thrift among the students
7. To promote appreciation of and respect for manual labor

From the standpoint of the students, the objectives may be stated in the following terms:

1. To earn money while finishing high school
2. To know how to plan for a future job by actually having one
3. To acquire the skills as well as the habits and traits necessary for success

In the places visited by the writer, the percentage of the seniors taking the program varies, ranging from 60 per cent in one small city in New York to 10 per cent in a city in Pennsylvania. The parents, whose written consent had to be secured before a pupil could be admitted into the program, seemed to have merely followed the wishes of their children. The employers met by the writer seemed to be generally in sympathy with the program and what it is trying to accomplish.

For Philippine education, the implications of the American trends and practices are quite clear:

1. The period of stress is the time for fundamental curriculum change. The program of economic and social rehabilitation in the Philippines seems to be the clue to fundamental curriculum reorganization in many directions, but most promisingly in the area of work-experience education.
2. The emphasis on education for all American youth is an inspiring idea that should make Philippine educators work ceaselessly for the enrollment of all Filipino boys and girls of high school age. This, of course, underlines the heavy responsibility of designing a high school curriculum that will meet the needs of youth rather than perpetuate traditional standards or the war for academic units.
3. Honest work is respectable. It has a definite educational value.

Plan of a work-experience program for the Philippines.—A work-experience program for the Philippines is proposed in accordance with the following guiding principles:

1. The new coöperative work-experience curriculum should be introduced gradually.
2. This program should be introduced only in those communities which have been educated to the point where the local official, community leaders, and the teachers and students ask for it.
3. The few schools where the program will be tried should be given every possible help in order to avoid failure.
4. The laws on labor and wages should be upheld by the school on all occasions.

Perhaps one of the first steps in planning for the program is the formulation of purposes or objectives in the language of the particular community which the program should serve. This should not be viewed as a mere formality, for then it would have no value. Properly understood, the objectives should be a guide against floundering.

The following suggestions will make the experimental set-up clearer:

1. The new program will affect only the senior year of the comprehensive high school. It will include both boys and girls. Students must be at least 16 years of age to be permitted to enroll in the program.
2. The program will only be for the students who desire it; Those who do not want to take the program can follow the usual schedule of work in school shops and school projects.
3. Introducing the program in many places at the beginning may be inadvisable. On the basis of the lessons learned when the general curriculum was first introduced in 1932, it seems proper to suggest that not more than four high schools should offer it in the beginning. The high schools where the program may first be tried should be of the following types: one large city high school; one medium-sized city high school; one high school in a medium-sized town; and one high school in a small rural town.

A schedule such as the following may serve as the in-school phase of the work-study program:

	Minutes Per Week
Related Language Instruction	300
Related Social Studies	300
Related Instruction and Occupational Problems	300
	900

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It represents a new departure from the usual method of subject-matter "addition and subtraction," and yet it is conservative enough to show some relationship with the program to which the people have been accustomed. The local communities will reserve the right to approve or change the schedule in accordance with their best judgment.

The proposed schedule will keep the students in school for three hours of schoolroom work daily. To go beyond this total number of minutes may make the schedule too heavy considering that a half-day of at least three hours will be spent in part-time employment.

The financing of the program is an important consideration. Where people are willing to support the program because it is good education, they may be expected to approve a higher tuition rate or to insist on a larger transfer of funds from the provincial government. A careful study of probabilities will save much disappointment later. The national government may also be expected to shoulder at least part of the financial responsibility since it is a program that is so closely related to the national objective of a balanced and diversified economy.

What are the potentialities of the work-experience program for the Philippines?

1. The youth will find in the program the answers to some of their strivings for financial gain and for the mental and emotional health that grows with the feeling of security, recognition, and the sense of achievement.
2. The home or family will find in this program an opportunity to convert a few easily wasted hours into values that can make for a more orderly and wholesome home life.
3. The school, if it has the requisite humility, will find in it a great lesson in institutional coöperation.
4. The business and industrial groups in the community will see in this program a source of informed help taught in the value of work and skilled in certain activities which have a recognized place in the adult world.
5. The country will see in it an opportunity to accelerate the program of economic and industrial development.

Microfilm $5.70; Xerox $20.00. 447 pages.

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SOME DIFFERENCES BETWEEN MENTALLY RETARDED CHILDREN IN SPECIAL AND IN REGULAR CLASSES IN THE SCHOOLS OF MERCER COUNTY, PENNSYLVANIA

(L. C. Card No. Mic 59-2913)

John S. Schell, Ed.D.
The Pennsylvania State University, 1959

Problem -- It was the purpose of this study to evaluate changes in mentally retarded children produced by the adjusted techniques of elementary special education classes.

Procedure -- The investigation was divided into two major parts. The initial phase was a two year study designed to measure changes between an experimental special class group and a control group of retarded children in regular classes. The two groups were enrolled in different schools with the regular class in a school which had no special education program. The schools were selected on the bases of similar philosophy, enrollment, physical plants, teacher-pupil ratio, and general community economic factors. Fifteen pairs of children were matched in terms of Binet IQ, chronological age, mental age, and sex. A battery of standardized tests was administered while both groups were in regular classes and again two years later. During this two year period, the experimental group had been enrolled in a new special class and the control group had remained in regular classes. The battery included the Stanford Achievement Test, the Vineland Social Maturity Scale, the California Test of Personality, and the Haggerty-Olson-Wickman Behavior Rating Schedule. The Wechsler Intelligence Scale for Children was administered and data regarding discipline were collected. Home visits were made at the beginning and end of the two year period.

The second phase or expanded study contained fifty-four mentally retarded children who had been in special classes for at least two years and fifty-four in regular classes of schools having no special education. A total of eight Mercer County Schools was used with four in each group. School matching was on the bases of size and community factors. The children were matched as in the first part except pairing was not used. A Student's Questionnaire, Parents' Questionnaire, and Check List for Pupil Activity and School Behavior were carefully devised with the comprehension level and desirable goals of the education for the retarded as bases. The Student's Questionnaire was individually read to each student by his elementary supervisor who also made between four and eight classroom visits in completing the Check List for pupils in his school. The Parents' Questionnaires were mailed to the parents.

Results

1. There were no significant differences in reading average, spelling, arithmetic average, or total achievement gains made by the groups during the two year period. Achievement quotients, however, demonstrated that both groups were slightly above the level expected of their mental ages.
2. The special class made a slight gain in mean social maturity quotient with a slight loss for the regular class. Neither was significant.
3. In terms of personality, the special class showed a somewhat better personal adjustment, and the regular class slightly improved social and total adjustments. No changes were significant.
4. Neither teachers' ratings or discipline records showed any significant behavior differences.
5. The Student's Questionnaire yielded significant differences for seven of the twenty-five items and indicated more of the special class children showed desirable attitudes regarding general learning, status, and group relationships.
6. Significant differences for sixteen of the twenty items on the Parents' Questionnaire showed more of the parents of children in special classes were satisfied with school. This satisfaction was reflected in parental attitudes regarding the child's group adjustments, self development, and general learning experiences.
7. Significant differences favoring the special class group were obtained for twenty of the twenty-five behavior check list items. The elementary supervisors' observations indicated this group was

superior in developed independence, self awareness, and group awareness.

Microfilm $2.00; Xerox $5.80. 120 pages.

AN INVESTIGATION OF THE EFFECTS OF A SEVENTH AND EIGHTH GRADE CORE PROGRAM ON PUPIL PROGRESS IN SELECTED AREAS IN SENIOR HIGH SCHOOL

(L. C. Card No. Mic 59-318)

Bernard Schwartz, Ed.D.
Temple University, 1958

Recognizing the crucial need for obtaining factual evidence about the effects of the core program in the educational field today, an attempt was made in this study to shed some light on the relationship between participation in a core program and success as a high school student. The initiation and operation of a core program thrusts heavy burdens upon the shoulders of school administrators and teachers. The transformation from the traditional teaching system to the core system greatly affects all who are either directly or indirectly involved in the field of education. Therefore it is cogent to evaluate the effects that the core program produces upon its students, as compared with those elicited by the conventional method.

The participating subjects were members of the 1957 senior class at Pennsbury High School, Yardley, Pennsylvania. The experimental group consisted of 80 students, 38 males and 42 females, who had participated in the core program at the junior high school level at Pennsbury in grades seven and eight. The control group totaled 88 students, 42 males and 46 females, who did not learn through a core program in grades seven and eight. The core students were intermingled with non-core students in the high school homerooms and instructional classes. Thus the students comprising the two groups had the same teachers and received the same instruction and attention.

The two groups were equated on the following factors: (1) number within each group; (2) sex; (3) chronological age; (4) high school instruction; (5) high school areas of concentration; (6) intelligence; (7) sixth grade evaluations of school marks, standardized achievement test results, and intelligence quotients; (8) socio-economic status via educational level of parents and occupation of the chief wage earner.

In order to determine achievement in subject matter and skill areas as measured by standardized tests, the core and non-core groups were compared on each of the nine sub-tests comprising the Iowa Tests of Educational Development. This battery was administered to all the participating students in the tenth grade and again in grade twelve. Results of the California Reading Test, administered in grade eleven were also analyzed. Comparisons between the two groups were made for scores obtained in the reading vocabulary section, the reading comprehension section and the total reading score.

Final report card marks, listed numerically, for grades ten, eleven and twelve were obtained from the school files. The control and experimental groups were then compared for each year by averaging the marks achieved in the five major subjects carried by each student. In addition, separate comparisons were made of the two groups on marks achieved each year on the two subjects which all students were required to take - English and social studies.

In grade ten and again in grade twelve all participating subjects were rated on a variety of personality and behavior traits. The ratings were performed for each student by the five teachers he had in his five major subjects. By assigning numerical weights to each step within each attribute scale, it was possible to adapt these evaluations for statistical analysis. Comparisons were then made between the control and experimental groups for each of the six personality and behavior characteristics rated in the tenth grade and for each of the seven attributes rated in the twelfth grade.

Three approaches were employed in determining differences between the core and non-core groups on the topic of the amount and extent of extra-curricular participation in high school. The first approach involved noting the number of activities in which each student participated each year. The second appraisal involved examination of the types of extra-curricular activities in which the students were participants. The final approach entailed determining the amount of time (hours per week) the students devoted toward extra-curricular participation. Employing the last approach it was possible to compare the control and experimental groups in grade twelve only. However, group comparisons in grades ten, eleven and twelve were made for the first two types of extra-curricular activity appraisals.

It was deemed important to ascertain whether results and significant differences noted in the tenth grade comparisons of core and non-core groups also persisted through grades eleven and twelve. Included in this phase of the investigation were: results of standardized achievement tests in subject matter and skill areas; high school report card marks; four of the rated personality and behavior traits, and number and types of extra-curricular activities participated in by the students.

A student attitude scale was adopted and revised for the purpose of obtaining indications of the social adjustment and school attitudes of the participating pupils. The following four areas were derived: (1) personal-social adjustment, (2) attitude toward classmates, (3) attitude toward teachers, and (4) attitude toward school administrators and school operation. Comparisons between the control and experimental groups were made on the total scale scores and on the scores for each of the four established areas.

Within the limitations of this study, the following conclusions can be drawn regarding the specific hypotheses established:

1. The hypothesis that high school students who have learned through a core program in junior high school achieve significantly higher scores in various subject matter and skill areas as measured by standardized tests can be accepted in part.
2. The hypothesis that high school students who have learned through a core program in junior high school achieve higher final marks in grades ten, eleven, and twelve can be accepted.
3. The hypothesis that high school students who have learned through a core program in junior high school exhibit more favorable personality and behavior traits when rated by their teachers can be accepted in part.

4. The hypothesis that high school students who have learned through a core program in junior high school participate in a greater number of extra-curricular activities can be accepted. However, the hypotheses that they participate in a greater variety of extra-curricular activity and that they devote more time to these activities must be rejected.

5. The hypothesis that high school students who have learned through a core program in junior high school maintain or increase their advantage over non-core experienced students in the above factors as they progress from grade ten, to grade eleven, and then to grade twelve can be accepted in part.

6. The hypothesis that high school students who have learned through a core program in junior high school exhibit more favorable social attitudes and more favorable attitudes toward various aspects of school life as measured by a standardized student attitude scale must be rejected.

Microfilm $2.00; Xerox $6.40. 131 pages.

THE EFFECT OF STUDENT-TEACHING UPON STUDENT TEACHERS' OBJECTIVES AND THEIR RELATION TO ACHIEVEMENT AND ATTITUDES TOWARD CHILDREN

(L. C. Card No. Mic 59-2920)

Nicholas Francis Troisi, Ed.D.
The Pennsylvania State University, 1959

The Problem. The purpose of this study was to investigate the relationship between student teachers' objectives for student teaching and the student teachers' achievement of these objectives and attitudes toward children's behavior.

Instruments Used. As a measure of objectives for student-teaching a Rating Scale For Student-Teaching Objectives was constructed by the author.

The measure of attitudes toward children's behavior selected for use was the Minnesota Teacher Attitude Inventory.

A Student-Teaching Achievement Scale for recording the achievement of student-teaching objectives was used.

The Procedure. A pilot group consisting of forty-five test subjects at the State University Teachers College, Plattsburgh, New York, afforded an opportunity to evaluate the instruments used. The text subjects were pre-tested on the Rating Scale and the Minnesota Teacher Attitude Inventory prior to student-teaching during their senior year. The test subjects were again administered the Rating Scale and the Minnesota Attitude Inventory at the end of their first nine-week teaching experience. The same pattern of test administration was followed for a third time at the completion of their second nine-week teaching experiences. Each cooperating teacher was asked to complete a Minnesota Teacher Attitude Inventory and use a Student-Teaching Achievement Scale to record the student's achievement of the objectives for student-teaching.

The main study group of 180 test subjects were senior student-teachers at the State University of New York Teachers Colleges at Fredonia, Oneonta, and Plattsburgh in the fall semester of the 1956-57 academic year. The procedure followed was similar to the pilot-group pattern with one exception. The second or middle administration of the Rating Scale and Minnesota Teacher Attitude Inventory to the subjects of this study was omitted.

Conclusions

The statistical analysis of the data gathered rendered the following results:

1. There is no significant relationship between the scores that a group of student teachers will make on the Rating Scale For Student-Teaching Objectives and on the Minnesota Teacher Attitude Inventory.

2. There is no significant relationship between the scores that a group of student teachers will make on the Rating Scale For Student Teaching Objectives and on the Student-Teaching Achievement Scale.

3. There is no significant relationship between scores that a group of student teachers will make on the Minnesota Teacher Attitude Inventory and scores made by their cooperating teachers on the Minnesota Teacher Attitude Inventory.

4. The student teachers after student-teaching rated the Objectives For Student Teaching significantly higher than prior to student-teaching.

5. The student-teaching experience increased the student teachers' Minnesota Teacher Attitude Inventory scores. The difference between pre- and post-scores was found to be statistically significant.

Microfilm $2.00; Xerox $5.40. 109 pages.

A STUDY OF THE RELATIONSHIP BETWEEN NURSING STUDENTS' KNOWLEDGE OF SCIENTIFIC PRINCIPLES AND THEIR ABILITY TO APPLY THESE PRINCIPLES IN NURSING SITUATIONS

(L. C. Card No. Mic 59-2211)

Mary Stickels Tschudin, Ph.D.
University of Washington, 1959

Chairman: John E. Corbally, Ph.D.

The study was concerned with whether nursing students' knowledge of scientific principles was associated with their ability to make correct decisions for nursing action. Writers in many professional fields, including nursing, have emphasized the need for workers whose professional performance would be guided by scientific facts and principles rather than by memorized rules or routine procedures. Objective data on the relationship of knowledge of scientific principles and ability to apply knowledge were lacking in the field of nursing.

Specific objectives for the study were: (1) to determine whether there was a significant relationship between knowledge of principles from the physical and biological sciences and ability to choose the correct course of action in nursing situations as measured by a written test; (2) to determine whether there were significant differences among nursing students in the extent of this relationship; and (3) to investigate the nature of differences among students regarding their reasons for choosing particular courses of action in nursing situations.

The test used in the study was a situationally based, multiple-choice type test composed of two parts. One part

was designed to measure ability to make a correct decision regarding nursing action. The second part was designed to measure ability to recognize the relevance of facts and principles from anatomy, physiology, microbiology, physics and chemistry to decisions for nursing action. Both parts of the test required the student to analyze nursing situations as a basis for selecting the proper nursing action or for identifying the scientific principle operating in the situation.

Test data were obtained from 668 students in six university schools of nursing. Approximately half of these students were in their freshman or sophomore year and the other half were in their junior or senior year.

Information was obtained from eighty-six students in one of the six schools of nursing regarding their reasons for having chosen particular nursing actions on twenty-five randomly selected items from one part of the test.

Product-moment coefficients of correlation between student scores on the two parts of the test were obtained for all students, early and late clinical students and for high and low scoring groups on each part of the test. The reasons which students gave for their nursing action decisions on the test were categorized and analyzed by means of the Chi-square method.

A substantial relationship was found between the two parts of the test. The extent of this relationship, however, did not differ significantly for early and late clinical students nor for high and low scoring students.

Significant differences were found between the various student groups in the kinds of reasons which they gave to explain their nursing action decisions. Late clinical students tended to give acceptable statements of scientific principles, acceptable rules and to cite experience. Early clinical students, on the other hand, tended to give irrelevant or erroneous statements of principles and to indicate guessing. For all groups, correct responses on the course of action test items were found to be significantly associated with the use of acceptable scientific principles and acceptable rules. The use of unacceptable principles, unacceptable rules, opinion and guessing were negatively associated with correct nursing action decisions.

It was concluded: (1) that knowledge of scientific principles was positively associated with the ability to make correct decisions for nursing action; (2) the extent of this relationship did not differ with time in clinical nursing nor with the level of student achievement; (3) that knowledge of a particular principle of science did not assure its correct application; (4) that students differed as to the kinds of reasons which they used to explain their nursing action decisions.

Microfilm $2.70; Xerox $9.40. 206 pages.

MEASURING CHANGE IN FRAMES OF REFERENCE: AN EVALUATION OF A GENERAL EDUCATION COURSE

(L. C. Card No. Mic 59-2678)

Robert Linderman Willard, Ph.D.
Syracuse University, 1959

Statement of the Problem

One of the objectives of a general education course offered by the writer for sophomores at Utica College is change in the students' cognitive orientation toward more relativity of viewpoint from whatever absoluteness of viewpoint they have on entering the course. Measuring devices in common use were judged insufficiently reliable to evaluate this change and review of the literature revealed no tests appropriate for the purpose, although adequate statistical methods and some promising leads were found.

Tendency toward relativity was analyzed as tendency to accept change rather than depend on the status quo; tendency to synthesize rather than atomize or elementalize.

Procedure

Seven tests were constructed using ordinary life situations to trigger immediate attitudinal responses to items. From these responses it was assumed that the frames of reference of the subject which constitute the dependent variable could be inferred. Two other tests, called Word Preferences and Certification and Licensing, were constructed. On the basis of a pilot test, five of the situations tests and the Word Preferences test survived after the item analysis and intercorrelations.

The tests were administered as pre-test and post-test to 51 experimental and 99 control subjects, and three years later to 33 of the experimental and 60 of the control subjects. Comparisons were made of pre-test, post-test, and follow-up means and intercorrelations, of pre-test to post-test mean gains and pre-test to follow-up test mean gains. In addition, comparisons were made of the gains of experimental and control subgroups which scored highest and lowest on the pre-test, and an attempt was made to compare the gains of the experimental group on the objective tests with rated gains on their pre-test and post-test answers to essay questions.

Results and Conclusions

Omitting qualifications, the following results were found:

The dependent variable, tendency toward relativity, was measured with adequate reliability.

The tendency toward relativity of the experimental subjects was significantly increased after one semester of instruction in the general education course; that of the control subjects showed negligible gains or losses after one semester of instruction in content courses.

The experimental subjects increased their relative orientation significantly both in amount and generality; i.e., at the end of the term they were not only more relative with regard to the same item on the tests, they also generalized their relativity more from abstract classroom material to ordinary life affairs.

Experimental subjects whose initial relativity was low on entering the course gained more than those whose initial relativity was high; however, since the same sort of effect occurred with the control subjects, this result is not too meaningful.

The experimental subjects retained much of their increase in relativity of viewpoint after three years. All of their follow-up means were larger than their pre-test means; whereas the control subjects generally showed a loss in cognitive relativity from pre-test to follow-up test.

From these results it is concluded that it is possible to influence students' attitudinal structures, in general education courses, with some lasting effect, and that further research along lines similar to those used in this study is justified. Microfilm $2.55; Xerox $8.80. 195 pages.

ENGINEERING, AERONAUTICAL

STRESS DISTRIBUTION IN A MONOCOQUE CYLINDER CONTAINING A CUTOUT

(L. C. Card No. Mic 59-1768)

Clifford F. Berninger, Ph.D.
Polytechnic Institute of Brooklyn, 1959

Advisors: Nicholas J. Hoff and Joseph Kempner

Procedures for the calculation of the stresses in a three-bay monocoque cylinder containing a cut-out are given. Previous work on the subject has either assumed rigid rings or treated relatively long cylinders. In the latter case the effects of prescribed boundary conditions in the region of the cut-out are not subject to evaluation. In particular the effect of ring flexibility upon the stress distribution in such cases is shown to be pronounced.

The problem of determining the stresses around a cut-out in a long cylinder has been treated by several authors. The methods employed in the solutions for cases involving flexible rings consisted of representing the structure as rings, longitudinal stiffeners and shear carry skin panels. After derivation of suitable stress influence coefficients for a complete cylinder a collocation procedure was used to liquidate the loadings about a designated cut-out area.

The present analysis treats the skin as a continuous axially load and shear carrying member and derives an influence function for a concentrated axial load.

The influence for the case of rigid rings is shown to be expressible in closed form. The influence function for the flexible ring case is expressed as the rigid ring solution plus an additional series of harmonic terms which are due to the ring flexibility. However, because the strain energy of the rings is small for high harmonics of the shear flow, the perturbation terms to the rigid ring influence function converge rapidly. In this formulation the closed form solution of the rigid ring case retains the effect of the high order harmonics while the flexible ring effects are included in a limited number of low order harmonic terms.

Liquidation of the cut-out area loading utilizes the influence function and results in an integral equation of the second kind. The equation is solved approximately by use of the Galerkin Method.

A numerical example is given for a three-bay cylinder to which uniformly distributed axial forces are applied to the ends. Comparison of the rigid ring and flexible ring solution is made and the stresses in the cut-out region are given in curves.

Microfilm $2.00; Xerox $4.60. 86 pages.

ENGINEERING, CHEMICAL

HEAT TRANSFER TO FLUIDS WITH VARIABLE FLUID PROPERTIES: CARBON DIOXIDE IN THE CRITICAL REGION[1]

(Publication No. 25,404)

Robert Paul Bringer, Ph.D.
Purdue University, 1956

Major Professor: J. M. Smith

Heat transfer coefficients were measured for turbulent flow of carbon dioxide in the critical region. Under these conditions, the variation in physical properties across the film was severalfold. Due to this large and irregular variation, point or local heat transfer coefficients were determined since average coefficients were meaningless. This was accomplished by the use of an electrically heated test section as the heat source. The heat transfer rate was essentially constant over the entire tube length. Point heat transfer coefficients were then calculated by a knowledge of the heat transfer rate and the difference between the temperatures at the wall and in the bulk fluid at any point.

The experimental apparatus consisted of a heating and cooling cycle into which carbon dioxide was introduced at a desired pressure. Circulation of the fluid was provided by a canned rotor centrifugal pump. Power to energize the Inconel test section was supplied through a powerstat and transformer.

Experimental data were taken at a pressure of 1200 psia (the critical pressure of carbon dioxide is 1070 psia) and fluid temperatures from 70°F. to 120°F. (the critical temperature of carbon dioxide is 88°F). Four series of runs were taken at wall temperatures of 100, 110, 130 and 150°F. The Reynolds number range covered was 30,000 - 300,000.

The experimental results were theoretically predicted by a numerical integration procedure involving the rate equations for heat and momentum transfer. The computations were carried out on an electronic digital computer.

The agreement between theory and experiment was found to be within the experimental error.

The data were also compared to several empirical equations, but these equations failed to represent the data. An attempt was then made to generalize and simplify the results of the theoretical computations so that they would apply to all supercritical fluids. This attempt was partially successful. An equation was developed purely from the theory which should predict heat transfer data in the supercritical region. This equation was used in conjunction with a simple rule for determining at what temperature the physical properties in the Nusselt and Reynolds numbers should be evaluated.

Microfilm $2.75; Xerox $9.60. 211 pages. Mic 59-3159.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

1. This thesis appears in American Institute of Chemical Engineers' Journal, March 1957 as an article by Bringer & Smith. A footnote states that the tables of original data have been deposited as document #5118 with the American Documentation Institute, Photoduplication Service, Library of Congress, Washington, D. C. -- pages 89-91 of this thesis.

THE PYROLYSIS OF 9,9'-BIANTHRYL

(L. C. Card No. Mic 59-2878)

James Strickler Conroy, Ph.D.
The Pennsylvania State University, 1959

The pyrolytic behavior of the hydrocarbon 9,9'-bianthryl was investigated in order to determine the effect of the structure of the compound on the process of carbonization and the nature of the products formed. The compound was charred initially in the liquid phase, under its own vapor pressure, between 450° and 500°C. at soak times up to twelve hours. The raw chars were subsequently heated at temperatures up to 1000°C., and then were subjected to graphitizing temperatures above 2800°C. The crystallite parameters of the various chars and graphites were obtained from X-ray diffraction measurements. Benzene- and nitrobenzene-soluble products of the reaction were studied through their infrared and ultraviolet spectra, and mass spectroscopic analyses of the gases liberated during charring were obtained.

Extensive charring of the hydrocarbon took place between 450° and 500°C., producing non-graphitic graphitizable carbons in yields up to 72% by weight of the charge. The interlayer spacings of the graphitized carbons ranged between 3.357 and 3.370 A., with crystallite heights between 350 and 2000 A. The most highly graphitizable carbons were produced from raw chars obtained after nine and twelve hours at 450°C.

Degradation of the bianthryl also occurred, producing hydrocarbons of lower molecular weight. Anthracene was obtained at 500°C., and benzene and alkylated derivatives were isolated at 450°C. Other aromatic structures were also formed but were not identified. Nitrobenzene-soluble material obtained from the low-temperature chars had characteristics of both chars and highly condensed aromatic systems, as indicated by its infrared spectrum and X-ray diffraction pattern. Hydrogen was the major gaseous product of the reaction, and was accompanied by small amounts of methane and other aliphatic hydrocarbons.

Thus low-temperature pyrolysis of 9,9'-bianthryl produces chars and carbons similar to those obtained from anthracene under comparable conditions, indicating that the two compounds carbonize in much the same manner. High, relatively constant char yields under the different conditions studied suggest that the reaction proceeds through rapid intramolecular condensations followed by intermolecular condensations, forming the basic carbon structure very quickly. The degradation products obtained are probably the result of hydrogenolysis of a portion of the bianthryl by hydrogen liberated during the early stages of the condensation process.

Microfilm $2.00; Xerox $4.80. 91 pages.

FLOW OF NON-NEWTONIAN FLUIDS IN ANNULI

(L. C. Card No. Mic 59-2768)

Arnold Gerhard Fredrickson, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor R. Byron Bird

A theoretical and experimental investigation of the flow of non-Newtonian fluids in concentric cylinder annuli has been made. The literature pertaining to the flow of non-Newtonian fluids has been reviewed. The review of the literature may be divided into three categories: The review of the rheological classification of matter; the review of the various models which have been proposed to correlate viscometric data; and the review of the methods which are currently available for predicting pressure drop-flow rate relations for a number of flow situations.

Analytical solutions of the equations of change for axial annular flow under the influence of a pressure gradient and/or a gravitational acceleration have been derived for several types of non-Newtonian fluids. These solutions have been presented in graphical and tabular forms for the flow of fluids which obey the Bingham plastic or the power model of rheological behavior. In addition, a solution for the combined axial and tangential flow in a concentric cylinder annulus of an arbitrary non-Newtonian fluid which does not exhibit visco-elasticity or a time dependent viscosity has been derived. This solution is also applicable to axial flow of an arbitrary non-Newtonian fluid.

Rheological data for five non-Newtonian fluids were obtained with a pressure actuated capillary tube viscometer. The five fluids were aqueous solutions of carboxymethyl cellulose of varying composition (0.6 to 3.5 % by wt.). The range of stresses studied was from 116 dynes/cm^2 to 11,600 dynes/cm^2.

Annular flow data for three of the carboxymethyl cellulose solutions were obtained with a modified pressure actuated viscometer. Comparison of the experimental annular flow data with the analytical solutions mentioned above showed that the power model solution may be used only over limited ranges of stress, whereas the solution for the arbitrary non-Newtonian fluid correlated the experimental annular flow data in a satisfactory manner. Microfilm $6.25; Xerox $21.60. 489 pages.

DROP-SIZE DISTRIBUTIONS FROM PNEUMATIC ATOMIZERS

(L. C. Card No. Mic 59-2770)

Keun Young Kim, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor W. R. Marshall, Jr.

A study was made of pneumatic atomizers in which a liquid is disintegrated into droplets with high-velocity air. This method of atomization has received a large amount of attention because of its operational flexibility and its

ability to produce fine sprays and to handle viscous liquids. However, there are very little reliable data available. For this reason, it is now difficult to predict the size of a spray from an atomizer or to design a nozzle to perform in a predicted manner. As the application of pneumatic atomization increases, the study of this process becomes urgent. Therefore, this study was aimed at collecting general information on performance characteristics of this process.

Effects of several variables on drop size were investigated using a spray cooling technique. The materials used were a microcrystalline wax having an average molecular weight of 890 and a polyethylene of low molecular weight, 2,500. The viscosity was varied by using different proportions of these two constituents. The size analysis techniques employed were microscopic sizing for samples having mass median diameters smaller than 70 microns and sieving with calibrated screens for samples larger than 70 microns. The investigated atomizers were both of the convergent and concentric double air-nozzle types. The atomizers were designed so that both types could be formed in the same body interchangeably.

Number distribution data obtained from microscopic sizing were processed by an IBM digital computer to calculate volume distribution and other statistical diameters of the samples. From the calculated volume distributions of the counted samples and weight distribution data directly obtained by sieving, the mass median diameters of sprays were correlated in terms of operating variables and physical properties of the liquid.

The correlation equation contained two terms. The first term was designated as the limiting size and was considered to be the minimum obtainable with a given atomizing air rate and nozzle. The important groups introduced in the correlation were the Weber number (based on relative velocity and liquid nozzle diameter), Z-number (liquid nozzle dimension and physical properties of liquid), and mass flow rate ratio (atomizing air to liquid rate). The check runs with nigrosine solution by a spray drying method conformed well with the wax results. The error range was ± 24.2 percent for the convergent type and $\pm 27.3\%$ for the type with concentric double air nozzles.

The ranges of the variables studied were: size, 6 to 350 microns mass median diameter; mass flow rate ratio, 0.06 to 40; relative velocity, 250 ft./sec. to sonic velocity; viscosity, 1.0 to 50 centipoises.

The Sauter mean diameter was always about eight tenths of the mass median diameter. The standard deviation of the spray increased linearly with the mass median diameter. However, the ratio of a particular percentage diameter (of the volume distribution) to the mass median diameter was constant irrespective of operating conditions. It was found that the generalized curve of cumulative volume distribution could be fitted by a modified form of the logistic equation.

The energy required for the creation of new surface area was a very small fraction of the total power input in pneumatic atomization. For a coarse spray, such as 100 microns mass median diameter, the efficiency was a few tenths of the energy input, and was comparable with other methods of atomization. For a very fine spray such as 5 microns mass median diameter, however, it was only 10^{-6} of the energy input.

The empirical correlations of mass median diameter and size distribution can be used in designing a nozzle for a specified performance and predicting drop sizes, when Newtonian liquids are to be atomized.

Microfilm $3.80; Xerox $13.00. 296 pages.

SOLVENT RECOVERY COMPARISONS FOR A LIQUID AMMONIA EXTRACTION PLANT

(L. C. Card No. Mic 59-2896)

Harry Lawroski, Ph.D.
The Pennsylvania State University, 1959

This thesis develops and evaluates simple and economical solvent extraction recovery systems for liquid ammonia type solvents as applied to petroleum fractions.

Solvent extraction principles are briefly discussed to provide a background for selecting a suitable solvent. These include the properties of solvents, phase diagrams and practical separations in a multi-stage counter-current extractor. The effects of the main variables such as solvent selectivity, solvent to oil ratio, solvent purity and stage distributions on the separations in the extractor are developed.

Solvent recovery methods are critically examined to point out the advantages and disadvantages of each. These methods include (1) distillation which can be used to recover pure solvent for recycle, (2) cooling which can be used to recover impure solvent, (3) scrubbing with a "wash" oil which can be used also to produce impure solvent, and (4) reactions which can be used for limited regeneration of solvent.

The properties of ammonia solvents (ammonia and monomethylamine) are developed. These include the physical properties for solvent recovery considerations as well as the extraction properties such as solubility and selectivity.

The extractions of twelve typical commercial feedstocks with ammonia solvents are briefly explained. The feedstocks have normal boiling points from 140° to 1000°F. and include most of the major type hydrocarbons. The extraction temperatures range from 43° to 113°F., and solvent to oil weight ratios of 1.2:1 to 65:1 are used. The ammonia solvent is modified with monomethylamine to increase hydrocarbon solubilities and water to decrease solubilities.

Data on anti-knock studies for gasoline improvement by extraction of thermal and catalytic cracked naphthas as well as hydroformates are given. Special studies for the use of impure solvents and anti-solvent injection in extractor operations are presented. Some solubility characteristics at temperatures from 140° to -40°F. for ammonia type solvents and selected hydrocarbons are given. The distributions of o-xylene, a C-10 aromatic hydrocarbon fraction, and a polynuclear aromatic hydrocarbon between ammonia solvents and "wash" oils are examined to obtain a perspective on "wash" oil type solvent recovery systems.

Thirteen different flow plans for the extraction of a catalytic cracked gasoline using liquid ammonia as the solvent are developed to compare the economics of different solvent recovery methods. One flow plan using diethylene glycol with water is developed as a comparison of a high boiling solvent.

A cooling type recovery system using a heat exchanger and auto-refrigeration of the solvent to furnish temperature gradients for heat transfer is found to be the least costly solvent regeneration method. The most versatile system with the lowest operating cost is calculated to be a vapor recompression system for solvent recovery, and anti-solvent injection for extractor solubility control.

Possible future work is discussed briefly.

Microfilm $4.25; Xerox $14.40. 332 pages.

EFFECTS OF THE RATE OF HEATING ON THE PROPERTIES OF A LOW TEMPERATURE VITREOUS CERAMIC BODY

(L. C. Card No. Mic 59-2745)

John Walter Lindenthal, Ph.D.
The Ohio State University, 1959

The object of the study was to select a ceramic body, fire it with a variety of heating rates, and determine the effects of these rates of heating on its physical properties. A low-temperature vitreous body, similar to ones being used commercially, was selected, and specimens were prepared by slip casting and plastic extrusion.

Preliminary tests of the differential thermal analysis and of the dimensional changes during the heating of the body were made. The thermogram of the body resembled closely that of a kaolinite, and no changes in dimensions occurred below 900° C. Above this temperature, a rapid shrinkage took place, continuing to near 1150° C. Based upon these results, it is felt safe to heat rapidly up to this critical period of rapid shrinkage and then reduce the rate while the body is vitrifying. The rate of heating at which the dimension change determinations were made had a negligible effect upon the temperature at which the shrinkage began. This has been attributed to the nature of the grain size distribution of the body, which contained few particles larger than 30 microns or smaller than 0.1 micron. A particle size distribution of this nature results in a homogeneous body, and thermal reactions proceed rapidly, while the absence of ultra-fines allows the preparation of slips with good working properties.

Firings were carried out in gas and electrically fired periodic kilns at heating schedules involving times of heating varying from one hour to 23 hours. The firing cycle was divided into six sections, each of which was investigated individually, while the others were held constant. These included the rate of heating to the first soak, the length of time and the temperature of the first soak, the rate of heating from the first soak to the maximum temperature, and the time and temperature of the final soak. The schedule upon which all of the cycles were based involved the heating from room temperature to 1500° F. in 30 minutes, a soak of one hour, and then an increase in temperature to 2100° F. in 20 minutes, followed by another soak of one hour. Data were obtained for firings in which each section of the firing curve was studied, and no significant differences were found provided a temperature of 2100° F. was reached, since this was the temperature at which the maximum strength and bulk densities were obtained.

A decrease in the rate of heating resulted in the disappearance of the fine crystalline particles of the body, as observed in etched, polished sections. Overfiring resulted in a decrease in the size of the crystals and in an increase in the number of holes or pores.

Thus it was apparent that this particular body, on a laboratory scale at least, would accommodate itself to any practical firing schedule.

Microfilm $2.00; Xerox $4.20. 78 pages.

INVESTIGATION OF INTERFACIAL PHENOMENA OF SELECTED METALS AND CERAMIC OXIDES

(L. C. Card No. Mic 59-2515)

Arthur Edward Lucier, Ph.D.
North Carolina State College, 1959

Supervisor: William Wurth Kriegel

The interfaces of Au-SiO_2, Au-TiO_2, Al-SiO_2, Al-TiO_2, Mg-SiO_2, Mg-TiO_2, Ni-SiO_2, Ni-TiO_2, Fe-SiO_2, Fe-TiO_2, Cr-SiO_2, and Cr-TiO_2 were investigated. Each metal was vacuum evaporated upon a glass film of either SiO_2 or TiO_2. The condition at each interface was explored by means of an electron diffraction pattern of a small area in the neighborhood of 3 microns by 4 microns. This small area was, in each case, photographed along with the electron diffraction pattern. From an analysis of the patterns and the areas selected, it was found that Ni and Cr wetted SiO_2 and TiO_2 glass better than Au, Al, Fe and Mg. Magnesium wetted SiO_2 and TiO_2 glass so poorly that magnesium crystals about 1300 Å were found coating the two glasses. In addition, instances of surface lattice adjustments were found at the interfaces of Al-SiO_2, Al-TiO_2, Fe-SiO_2, and Fe-TiO_2. Also, probable metal oxide formation occurred at the interfaces of Mg-SiO_2, Mg-TiO_2, Ni-TiO_2, Fe-SiO_2, Fe-TiO_2, Cr-SiO_2 and Cr-TiO_2. And also, TiO_2 crystallized at the interface of Fe-TiO_2, and at the interface of Cr-TiO_2 there appeared to be incipient crystallization of TiO_2.

Microfilm $2.00; Xerox $3.00. 56 pages.

NON-NEWTONIAN FLOW ABOUT A SPHERE

(L. C. Card No. Mic 59-2778)

John Charles Slattery, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor R. B. Bird

In a study of the flow of non-Newtonian fluids past spheres, two problems have been examined: the analytical solution of the equations of motion for a particular non-Newtonian model, and the measurement and correlation of friction factor data for non-Newtonian flow around spheres.

It is generally accepted that non-Newtonian fluids exhibit Newtonian behavior at very low stresses and also at very high stresses. A limiting case of non-Newtonian

behavior can be visualized in which there is no transition region between these two regions of Newtonian behavior, but rather the change takes place abruptly at a particular value of the stress. For an infinite body of fluid exhibiting such an idealized non-Newtonian behavior, the equations of motion were solved to obtain the velocity distribution around a very slowly moving sphere; the macroscopic momentum balance and the Bernoulli equation were used to determine the drag force acting on the sphere. To the knowledge of the writer, this is the first solution to the equation of motion for flow about a sphere of a non-Newtonian fluid.

The rates of fall of spheres through six aqueous solutions of carboxymethylcellulose (CMC) were studied; the experiments were designed to give data for spheres falling at their terminal velocities through tubes in the absence of boundary effects. Two methods were used to time the fall of the spheres: 1) for a rapidly moving sphere the descent was recorded in a sequence of photographs which gave the average velocity over three sections of the tube and 2) for a slowly moving sphere the observer timed the fall with a stop watch. Three glass cylinders thirty inches high were used; their inside diameters were approximately four, five and six inches. Two sets of spheres were employed, a set of steel bearing balls ranging in diameter from 0.025 inch to 1/2 inch and a set of 1/2 inch glass spheres of varying density. These six solutions of CMC were also studied in a tube viscometer to determine their rheological behavior.

Making the assumption that the rheograms for these solutions could be described by the "Ellis model"

$$-\frac{dv_z}{dr} = \varphi_0 \tau_{rz} + \varphi_1 \tau_{rz}^n$$

we were able to prepare a dimensionless correlation of the drag coefficient in terms of a modified Reynolds number and two other dimensionless groups. For $Re_1 < 0.1$ an empirical equation was developed which reduces properly to Stokes law for a Newtonian fluid; for $Re_1 > 0.1$ a graphical correlation of the drag coefficient was prepared. The average error in the drag coefficient calculated from this correlation was 10.4 percent for 294 experimental points representing five fluids. This work is of value for the prediction of the drag coefficient for non-Newtonian flow about a sphere; no such correlation was previously available. It also implies that the influence of the third invariant of the stress tensor,

$$I_3' = \det \left| \tau_{ij} \right|$$

upon the behavior of the fluid is a second-order effect; the effect of I_3' has been unexplored up to this time. In addition this work suggests that the Ellis model may be useful in describing non-Newtonian flow in various geometries. Microfilm $2.70; Xerox $9.40. 206 pages.

HIGH TEMPERATURE ENERGY RELATIONSHIPS IN THE ALKALI BORATES

(L. C. Card No. Mic 59-2916)

George Sherwood Smith, Ph.D.
The Pennsylvania State University, 1959

Although most of the properties of glass have been studied in a detailed manner, only a few investigations have been concerned with the energy relationships existing in glassforming systems. There exists at present no comprehensive study of this type dealing with glasses. The need for thermodynamic data coupled with a rapid and accurate method for determining heat contents has led to this study of the energy relationships in the alkali borates.

The energy relationships for binary and mixed alkali borates, containing up to 33 mole per cent alkali, have been studied in the temperature range 25°-1100°C. High temperature heat content, entropy and heat of solution data are supplied for both the glasses and the corresponding devitrified products.

The heats of solution were determined in 2 N nitric acid in a Dewar flask calorimeter at 25°C. The high temperature heat contents were determined using a dynamic method. The calorimeter and the method of operation is described in detail. The heat of solution difference existing between a glass and its corresponding devitrified product is the heat content difference at 25°C. By superimposing the high temperature data (reference temperature: 25°C) upon the heat content difference at 25°C the energy relationships at high temperatures are obtained. The overall accuracy of the data is estimated to be $\pm$ 3 per cent. These data are used to determine heats of fusion, heats of crystallization, entropy differences and free energy differences at 25°C.

The heats of fusion were determined for $Li_2O \cdot 2\ B_2O_3$ (28,770 cal./mole), $Na_2O \cdot 2\ B_2O_3$ (18,130 cal./mole), $Na_2O \cdot 4\ B_2O_3$ (31,330 cal./mole) and $K_2O \cdot 4\ B_2O_3$ (18,130 cal./mole. A comparison, on a gram atom of oxygen basis, shows that the heats of fusion follow the order: Li > Na > K. The entropy differences between glasses and their devitrification products at 25°C shows B_2O_3 to have a comparatively high value (1.90 cal./deg./gram atom oxygen) when compared with most of the alkali borate compounds (0.5-0.7 cal./deg./gram atom oxygen). $Na_2O \cdot 2\ B_2O_3$, however, has a very low value (0.11 cal./deg./gram atom oxygen) indicating a close similarity between the structure of the glass and the crystalline material.

The heat contents at a given temperature of the alkali borates were observed to decrease as the alkali content increased to 20 mole per cent. Further additions of alkali caused the heat contents to increase. This variation of heat content with composition is explained in terms of first a strengthened followed by a weakened structure as the alkali content increases. A close relationship was found between heat content and other physical properties such as viscosity, density and volume expansion.

Evidence for ternary compound formation in the lithium-sodium-borate system was found. X-ray data are supplied for these compounds as a guide to further investigation which is needed to define the exact compound compositions.

Microfilm $2.55; Xerox $9.00. 196 pages.

PHASE BEHAVIOR OF PROPANE-REDUCED CORNING CRUDE OIL SYSTEM

(L. C. Card No. Mic 59-2724)

Augustus Richard Van Kleeck, Ph.D.
The Ohio State University, 1954

The purpose of the investigation was to measure to some extent the response of a reduced Corning crude oil to propane deasphalting. In order to do this a phase equilibrium study was made of the two liquid phases resulting from contacting propane with reduced crude.

Equilibrium diagrams were constructed by plotting solvent to oil weight ratio versus specific volume of the solvent-free phase.

The equilibrium data were obtained according to the following procedure:

Measured quantities of propane and oil were charged into a temperature controlled stainless steel cell. Equilibrium between oil and asphalt phase was accomplished by agitation followed by settling. Each phase was entirely and separately drawn off into a trap. The oil remained in the trap and the propane associated with the phase flashed out of the trap and through a wet gas meter. Further depropanizing of the phases was accomplished by application of heat lamp and vacuum pump. The amounts of solvent free oil in each phase were then determined by weighing. The quantity of propane associated with each phase was determined from gas meter readings and weight differences before and after depropanizing. Measurement of the specific gravity of the oil from each phase completed the information required for location of two corresponding points on an equilibrium diagram. By varying the ratio of solvent to oil the entire equilibrium curve was obtained for each temperature investigated.

The above described equilibrium curves were obtained for three temperatures, 140°, 150°, and 170° F.

From the equilibrium diagram it is possible to calculate graphically the number of theoretical stages of extraction, yield, and solvent to oil ratio for a product of particular specific gravity.

Since the carbon residue test was regarded as the most significant measure of quality improvement in propane deasphalting, this property was measured and correlated with specific gravity.

With the above described data it is thus possible to select the correct operating variables for producing a product of specified carbon residue value.

Progressively increasing the initial ratio of solvent to oil has these results:

1. The solvent to oil ratio is increased appreciably in upper phase.
2. The solvent to oil ratio in lower phase remains practically constant.
3. In general the percentage yield increases, although a very slight dip can be detected for 140° and 150°F.
4. The specific gravity of the extracted oil passes through a minimum.
5. The carbon residue of the extracted oil follows the trend of the specific gravity. The minimum specific gravity corresponds to the minimum carbon residue.
6. Viscosity of the extracted oil follows the trend of the specific gravity. The lower the specific gravity, the lower the viscosity. Viscosity index remains essentially unchanged by the propane treating.

As the temperature of the extraction is increased, the yield decreases, and the specific gravity, the Conradson Carbon Residue, and the viscosity of the extracted oil decrease. At 170° F the properties of the extracted oil change but slightly with increasing solvent treatment, thereby giving a nearly straight and vertical equilibrium line for the upper phase. However, at this higher temperature the yield is sensitive to the amount of solvent used.

Regardless of the exact value of carbon residue required, the data indicates the following conclusions with regards to response of Corning reduced crude oil to propane deasphalting:

1. A carbon residue within the range of Pennsylvania-grade lubricating oil can be obtained.
2. A good yield of high grade lubricating oil is possible.
3. Theoretically the requirements for carrying out the solvent extraction to the desired degree are not excessive.

In order to further evaluate the application of propane deasphalting to Corning reduced crude oil, an economic study was made. This evaluation consisted of the calculation of a predesign capital and operating cost estimate for a proposed 1200 barrels per day plant. The calculations resulted in the following figures:

Total plant investment	=	$547,800
Operating cost	=	$0.68 per barrel of charge treated

Microfilm $2.00; Xerox $4.00. 73 pages.

Abstract published by special arrangement with The Ohio State University.

A MASS SPECTROMETRIC STUDY OF THE CARBON-CARBON DIOXIDE REACTION

(L. C. Card No. Mic 59-2922)

Francis Joseph Vastola, Ph.D.
The Pennsylvania State University, 1959

The carbon-carbon dioxide reaction was investigated at temperatures from 350° to 700°C. and at starting pressures from 2.7 to 16 microns of mercury. The reaction was followed by monitoring the partial pressure of the reaction gases with a mass spectrometer. The carbon used was spectrographic graphite(SP-1) ground in a vacuum ball mill to give an area of 560 square meters per gram. The grinding process introduced about 5 per cent of iron into the sample.

In order to investigate the extent and nature of any intermediate or surface complexes, the reaction temperatures used were considerably lower than any previously reported in the literature for the carbon-carbon dioxide reaction. The sensitivity of the mass spectrometer measuring system was great enough to detect surface coverage of as little as 0.01 per cent.

The reaction was found to be first order throughout the range of temperatures investigated. No build-up of any intermediate could be detected during the course of reaction. Therefore, if a multi-step reaction mechanism is postulated the first step, the consumption of the carbon dioxide, would have to be the rate-controlling step.

A small amount of the carbon monoxide produced during the reaction chemisorbed on the carbon sample. This chemisorbed carbon monoxide was found to be very stable at temperatures below 600°C. At temperatures above 600°C., the chemisorbed carbon monoxide could be removed.

The maximum amount of carbon monoxide that chemisorbed on the carbon surface corresponded to a surface coverage of 0.12 per cent. This small area was not the "active site" area where the reaction was taking place, for it could be covered with chemisorbed carbon monoxide prior to a reaction with carbon dioxide without appreciably affecting the reaction rate. This small amount of carbon monoxide chemisorption which occurred during the reaction could be taking place on the iron in the ground SP-1 carbon sample. A ground SP-1 sample from which the iron had been removed did not chemisorb any measurable amount of carbon monoxide.

The iron had a very strong catalytic effect on the reactivity of the carbon. The "iron-free" ground SP-1 sample had to be heated about 300°C. higher than the iron catalyzed material in order to obtain a comparable reactivity. Therefore, if the carbon monoxide is chemisorbing on the iron, it only must be covering areas which are not active in the catalysis of the reaction.

A possible mechanism by which the iron could catalyze the reaction would be:

$$(1) \qquad y\,CO_2 + x\,Fe \rightleftharpoons Fe_x O_y + y\,CO$$

$$(2) \qquad Fe_x O_y + y\,C \rightleftharpoons x\,Fe + y\,CO$$

In this mechanism the iron is oxidized by the carbon dioxide and reduced by the carbon. Under the experimental conditions used in this investigation, the forward reactions of both steps will predominate.

Microfilm $2.00; Xerox $3.80. 69 pages.

A NEW APPARATUS FOR LIQUID PHASE THERMAL DIFFUSION

(L. C. Card No. Mic 59-2685)

Edward Von Halle, Ph.D.
The University of Tennessee, 1959

Major Professor: Dr. Stanley H. Jury

Although the existence of a thermal diffusion effect in liquids has been known for more than 100 years, relatively little experimental work was done until the development of the thermogravitational column in 1939. It consisted of parallel hot and cold surfaces mounted vertically so that thermally induced convection currents, upward along the hot surface and downward along the cold surface, provided counter-current flow. One factor which has made experimental results obtained with thermogravitational columns difficult to interpret is the so-called forgotten effect. The forgotten effect refers to the effect on the column performance of that part of the density gradient due solely to the concentration gradient in the liquid. The objective of this work was, therefore, to design and construct a thermal diffusion column free of the ramifications caused by the forgotten effect and to establish the operating characteristics of this column.

A horizontal thermal diffusion column was designed and constructed in which two streams, one above the other, separated by a permeable cellophane membrane, moved countercurrent to each other. A vertical temperature gradient provided the separating potential. The countercurrent flow was achieved by means of conventional Sigmamotor finger pumps. These external pumps allowed the convective flow rate in the column to be regulated independently of the other process variables and thus provided a flexibility in operation not offered by the standard thermogravitational column. This column was operated, both at total reflux and with continuous product withdrawal, with water-ethyl alcohol mixtures of various concentrations.

A phenomenological theory for the separation behavior of the horizontal thermal diffusion column is presented. Values of the Soret coefficient were computed from the experimental results for water-ethyl alcohol mixtures. It was found that the Soret coefficient changes sign at a concentration of about 30 weight percent alcohol. For mixtures containing more than 30 percent alcohol the Soret coefficient is negative and the values obtained in this work are in agreement with those found by previous investigators; for mixtures containing less than 30 percent alcohol the Soret coefficient is positive and the values obtained in this work differ from those found previously. It is believed that the action of the forgotten effect in this concentration range prevented the determination of the true nature of the Soret coefficient by those who used thermogravitational columns.

A comparison is made between the separating efficiency of the horizontal thermal diffusion column and that of the thermogravitational column. It is concluded that the former is preferable for separating forgotten effect pairs while the latter has an economic advantage when the forgotten effect is absent.

An extensive compilation of the results obtained by previous investigators of liquid phase thermal diffusion and an annotated bibliography on all phases of thermal diffusion containing 690 references are included in this report. Microfilm $4.70; Xerox $15.60. 365 pages.

ENGINEERING, CIVIL

THE APPLICATION OF MACLAURIN'S SERIES FOR FUNCTIONS OF ONE OR TWO VARIABLES TO THE ANALYSIS OF PLATES IN BENDING

(L. C. Card No. Mic 59-196)

Porfirio Ballesteros Barocio, Ph.D.
Northwestern University, 1958

Supervisor: S. L. Lee

In this dissertation, Maclaurin's series for functions of one or two variables are applied to the analysis of plates in bending.

A historical review of the problem under consideration is given and important contributions are mentioned in chronological order. The fundamental concepts and assumptions of the theory of plates in bending are discussed and a brief review of the various boundary conditions is given.

Maclaurin's series for functions of one variable is described, from which Maclaurin's series for functions of two variables is derived. The series are given in terms of both rectangular and polar coordinates.

The application of Maclaurin's series to plate problems is first demonstrated by the derivation of rigorous solutions for the pure bending of rectangular plates and the bending of triangular, elliptical and circular plates with various boundary and loading conditions.

The use of Maclaurin's series to obtain, for rectangular plates, particular solutions which satisfy the boundary conditions partially is also presented. The boundary conditions discussed are: zero slope, zero bending moment, zero deflection and the case of moment parabolically distributed at the boundary. These solutions may be utilized, by themselves or by combination with others, to obtain exact or approximate solutions for certain problems. The procedure is illustrated in the following.

To obtain a new exact solution for a uniformly loaded and simply supported rectangular plate, the particular solution for a uniformly loaded rectangular plate satisfying the condition of zero deflection at the boundary discussed above is used. This particular solution yields a parabolically distributed moment at the boundary which has to be removed. This moment is first represented by a trigonometric series and a solution for a simply supported rectangular plate bent by the reversed moment applied at the boundary is obtained. The superposition of the latter with the above mentioned particular solution leads to the desired solution.

An approximate solution for a uniformly loaded rectangular plate supported only at the corners is obtained as follows. A particular solution satisfying the condition of zero reactive force at the boundary is first derived. This solution gives a small bending moment distributed at the boundary. Since the boundary conditions also requires that the bending moment at the edges be zero, this condition is satisfied by adjusting the values of the coefficients of the polynomial solution in such a way that the total area of the bending moment diagram at each edge equals zero. The accuracy of this approximate solution is discussed and values of the deflections and bending moments at strategic points in the plate are given in tables and graphs.

It is concluded that Maclaurin's series for functions of one or two variables may be applied advantageously to the analysis of plates in bending in cases where the solutions are algebraic functions. The number of terms in the series which remains in a solution depends upon the plate equation and the boundary conditions. If more terms than necessary are included in a trial solution, the coefficients of the extra terms will turn out to be zero provided an algebraic solution exists. If, on the other hand, it is not possible to satisfy the plate equation and the boundary conditions, it is highly probable that the solution, if it exists, is a transcendental function.

A discussion of the form of the general solution of the plate equation is also included. This general solution may be very helpful in finding new solutions for plate problems where the solutions are transcendental functions.

Microfilm $2.00; Xerox $4.80. 94 pages.

ENGINEERING, ELECTRICAL

A PRELIMINARY INVESTIGATION OF A HIGH-POWER HOLLOW-BEAM TRAVELING-WAVE-TUBE AMPLIFIER

(L. C. Card No. Mic 59-2816)

Murray Irving Disman, Ph.D.
Stanford University, 1959

This report describes an attempt made to demonstrate some of the advantages of using a hollow electron beam in a high-power traveling-wave-tube amplifier.

The most attractive property is probably the fact that it is possible to construct hollow electron beams having perveances that are much greater than solid electron beams. It is shown that this ability of hollow beams can result in TWT amplifiers that have a larger bandwidth, while at the same time having greater or comparable gains and efficiencies than a solid-beam TWT. Some of the other advantages of a hollow beam include the removal of the diameter restriction that is necessary for solid beams, the possibility of focusing the beam by means other than a confining magnetic field, more freedom in choice of an interaction circuit, and the elimination of X-ray problems for megawatt-level TWTs.

In an effort to illustrate some of these advantages a study of three different circuits, suitable for use with a hollow electron beam, is made. This investigation leads to the realization that the finned structure with an opposing conducting plane would have some interesting and desirable properties as a slow-wave circuit for a high-power TWT. The cylindrical form of the structure is then analysed in detail and some cold tests are made to verify the dispersion and impedance relations.

On the basis of the theoretical and experimental results it was decided that it would be desirable to build a megawatt-level TWT amplifier which used the disc-loaded coaxial-line structure. The tube was designed to operate at a beam voltage of 100 kv and a beam current of 60 amperes in order to utilize an available pulser. The frequency of operation centered about 3 kMc and the tube

was to have a net gain of 30 db with a 3-db bandwidth of at least 20 percent.

During the testing of the tube some difficulties were encountered with oscillations at the high-frequency cutoff of the first higher-order mode of the circuit. Some of the properties of this mode are found and several methods of applying selective loss are described. The methods described should present enough loss to the spurious mode to stop the oscillations without introducing excessive attenuation to the desired amplifying mode.

The oscillations were stopped by reducing the beam current to the point where the net loop gain, for the higher-order mode, was less than unity. It was possible to measure electronic gains at these currents and plots of gain vs frequency, for various beam voltages, are presented. The agreement between these experimental results and those predicted from the theory is quite good.

The tube is now being modified so that it will be possible to introduce some selective loss on the r-f circuit. It is felt that, with this modification, it will be possible to operate the tube at full rated current without encountering any difficulties due to spurious modes. In addition, on the basis of the results obtained at low-current operation, it seems reasonable to expect that the tube will satisfy the original design specifications when operated at full beam power. Microfilm $2.00; Xerox $6.20. 130 pages.

THE USE OF INFINITE PEAK-CLIPPING IN A TIME MULTIPLEX VOICE COMMUNICATION SYSTEM

(L. C. Card No. Mic 59-2694)

Sydney Thayer Fisher, Ph.D.
Cornell University, 1959

It has been known for some time that when a speech signal is differentiated, infinitely peak-clipped, and then integrated, its intelligibility is not seriously impaired. The thesis is that infinite peak-clipping may be used to great advantage in a time multiplex voice communication system.

To date the best method for transmitting speech by time multiplex over a noisy channel has been pulse code modulation. Pulse code modulation is superior to ordinary transmission because the transmitted signal is a train of on-off pulses representing the binary digits, 1 and 0. The receiver must be capable merely of detecting the presence or absence of a pulse.

It is shown that, when a pulse code signal is used to modulate a carrier, the output signal-to-noise-power ratio is approximately an exponential function of the signal-to-noise-power ratio of the carrier. Therefore a slight improvement in carrier signal-to-noise ratio causes a tremendous improvement in the output signal-to-noise ratio.

If an infinitely peak-clipped signal is sampled, the samples form a one-digit binary code. Ordinary, unclipped speech requires a five-to seven-digit code. Therefore, if the sampling rate of slipped speech is of the same order as that of unclipped speech, clipped speech affords a large saving in bandwidth over ordinary speech, thereby giving an enormous increase in output signal-to-noise ratio.

To prove that an infinite peak-clipping system is feasible, and that a sampling rate approximately the same as that for ordinary speech is required, a single channel of the proposed system, omitting the radio link, was designed and built by the author. Besides showing that a sampling rate between 10 and 15 kilocycles is satisfactory for clipped speech, the author performed experiments for counting the average number of zero-crossings and for measuring sampling errors.

The experiments, coupled with the theoretical noise study, show that the proposed infinite peak-clipping system may someday take its place among the array of communication equipment used by the military, the police, and other services in which communication of intelligence under adverse conditions is essential.

Microfilm $2.00; Xerox $7.00. 148 pages.

SOME PHYSICAL AND CHEMICAL PROPERTIES OF CARBON AND GRAPHITE ELECTRODES PREPARED FROM ANTHRACITE

(L. C. Card No. Mic 59-2883)

Irwin Geller, Ph.D.
The Pennsylvania State University, 1959

Petroleum coke is ordinarily used as a filler material in the manufacture of baked and graphitized carbon electrodes. It is mixed with a binder, such as coal-tar pitch, and either molded or extruded under pressure into various shapes. Because of the desirability of finding new uses for anthracite and because there is a shortage of petroleum coke of low sulfur content, the possibility of using anthracite as a filler has been investigated.

The purpose of the investigation was to determine and compare the physical structure of anthracite and petroleum coke electrodes and to relate this structure to their gas reactivities, electrical resistivities, and mechanical strength. Among the properties investigated, to delineate clearly physical structure, were pore size distributions obtained from mercury porosimeter data, densities measured in various media, surface areas from low temperature gas adsorption, gas diffusivities, and interlayer spacings and crystallite dimensions of the carbons from x-ray diffraction studies. The samples used in the investigation were one-half inch diameter extruded rods prepared from a petroleum coke and two different anthracites, which were baked at 1000°C. and graphitized at either 2400°C. or 2800°C.

Pore structures were found to be similar in nature for electrodes prepared from all three materials. Evidence was found which suggests that a closed pore structure was formed in the binder during baking, and this structure was expanded during graphitization. Electrical resistivities of the baked anthracites were found to be slightly higher than that of baked petroleum coke, but resistivities of the graphitized anthracites were found to be almost double those of the graphitized petroleum cokes. The resistivities appeared to depend almost entirely on the degree of graphitization. The strength of the anthracite rods seemed to be as good or slightly better than that of petroleum coke rods. It was not possible to correlate gas reactivity of the rods with any other properties, and there

was no significant trend to increased or decreased reactivity to carbon dioxide as a function of heat treatment temperature.

Anthracite does not seem to be satisfactory for the preparation of graphitized electrodes, because of its high electrical resistivity. However, it may find use in the production of amorphous carbon electrodes if an economical way is found to decrease the mineral matter content sufficiently before electrode manufacture.

Microfilm $2.00; Xerox $4.80. 91 pages.

AN INVESTIGATION OF THE SENSITIVITY OF SOME RECEIVERS HAVING LARGE R-F BANDWIDTH

(L. C. Card No. Mic 59-2818)

John Lynn Grigsby, Ph.D.
Stanford University, 1959

An investigation is made of the sensitivity of two types of receivers that have large r-f bandwidth. The receiver types considered are the superheterodyne with distributed-frequency local oscillator, and the crystal-video receiver employing r-f preamplification. The intent of the work is to determine the limiting values of the sensitivity of the receivers when the r-f bandwidth is at least several per cent of the band-center frequency.

The nonlinear-resistance mixer that is driven by a single-frequency local oscillator is examined in order to obtain a satisfactory understanding of the mixer performance before proceeding to the type of operation where a large number of effectively separate local-oscillator inputs are employed. Expressions are obtained for the output admittance of the mixer, the short-circuit current, and the broadband conversion loss. It is shown that the mixer may be represented as a device in which reciprocity holds only if the dynamic admittance of the nonlinear resistance and the signal-, image-, and intermediate-frequency voltages possess a time zero such that all four quantities are simultaneously even functions of time.

The noise figure of the distributed-frequency-LO receiver is determined as a function of the effective conversion loss of the mixer. It is shown that noise figures, based on the r-f bandwidth, approaching unity could be obtained if some means could be found to maintain the effective conversion loss for the distributed-frequency-LO receiver in the vicinity of that obtained for a single-frequency LO.

The sawtooth-frequency-modulated oscillator is examined in detail as the most likely source of a distributed-frequency-LO system. It is shown that an essentially uniform spectrum of discrete frequency components can be obtained by this method. The resulting excess conversion loss for any one LO component is, unfortunately, determined to be inversely proportional to the product of peak-to-peak frequency deviation and sweep time.

The crystal-video receiver employing r-f preamplification is investigated in order to determine the effective bandwidth and sensitivity. It is shown that in the case where a narrow-band preselector is used, the effective noise power output, during the time that a signal is applied, is proportional to the signal power.

An appendix is devoted to an analysis of the power spectrum of the product of two continuously-distributed power spectra at least one of which represents random noise.

Another appendix examines the output-power density function for integer-power-law devices that have a random-noise input. An iterative convolution integral is obtained so that given the nth term, the (n+1)th term may be determined.

Microfilm $2.30; Xerox $8.00. 173 pages.

THE LOGICAL DESIGN OF A GENERAL PURPOSE DIGITAL COMPUTER FOR EDUCATION AND RESEARCH

(L. C. Card No. Mic 59-2888)

Robert William House, Ph.D.
The Pennsylvania State University, 1959

Although general purpose, digital computers have been available, they have not, in general, been designed for the purpose of being used in a classroom for teaching computer design and programming. Some of the requirements for this purpose not usually found in commercial equipment are: (1) an adequate visual display for classroom observation; (2) a small number of explicit instructions that could be learned quickly by a beginning student; (3) a control panel reduced to the essentials for operations and allowing reduced-speed operation for instructional use; and (4) visible and accessible components that could easily be modified. These requirements for the proposed computer were counterbalanced by those required to enable useful scientific computation to be accomplished in the instruction of computer programming. It was the purpose of this investigation to achieve a design satisfying these requirements.

To make the design functional the computer was made to be part of a classroom with information display lamps placed at the top of the main cabinet in a manner such that they were visible to every member of the class. The design permitted the computer to be operated at reduced speeds: one operation at a time; one word transfer time at a time; and one pulse at a time. The decimal point could be placed at different positions in problems from different disciplines by means of a rotary switch on the console. To facilitate maintenance and instruction of computer design, the design used six logical, plug-in units for most of the construction. To help detect malfunctions, mistakes in coding and errors in programming, the design included internal checking of various kinds. To perform useful computation, a high speed magnetic drum was used for internal storage, a fast photoelectric reader was used for punched paper tape input and an electric typewriter was used for a printed output. In addition instructions were included enabling the computer to handle quantities larger than the normal word length of ten decimal digits plus sign.

The computer design used a one-plus-one instruction structure with a coded decimal number system using the 2*421 code. Information was transmitted throughout with the binary digits in parallel and the decimal digits serially. The magnetic drum used for storage also controlled the internal timing of the computer by means of a timing track on the drum. The drum rotated at 12,600 revolutions per minute and stored 2500 eleven decimal digit words.

The computer designed was built by the Department of

Electrical Engineering at the Pennsylvania State University and is in operation in the Digital Computer Laboratory.
Microfilm $2.60; Xerox $9.00. 200 pages.

ACCURACY OF TRACKING RADAR SYSTEMS

(L. C. Card No. Mic 59-2748)

Leon Peters, Jr., Ph.D.
The Ohio State University, 1959

The performance of various tracking radar systems in tracking complex targets is treated. The complex target is considered as a multi-point target. Such a target can be generalized to include targets that are finite in extent. The analysis is nonstatistical as compared with the usual practice of treating any tracking errors as tracking noise.

Various tracking systems are described in Chapter 1 in the chronological order of their development. The concept of balance point is introduced and the relation of its motion to tracking noise is mentioned.

In Chapter 2, the equations for the balance point are obtained in terms of the amplitudes and phases of the signals reflected from the point scatterers and the positions of these scatterers on the target. These equations may be rewritten in terms of the echo area pattern (phase and amplitude) and its first derivative. Solutions of the balance-point equation are compared with all other solutions known to the author to find that the results of the present solution are in agreement in all cases. It is concluded as a result of this analysis that the conical-scan tracking system and the phase-monopulse tracking system are the most accurate. The amplitude-monopulse system is equally accurate if the separation between antennas is negligible; if not, an additional error is introduced. The phase amplitude-monopulse system introduced a cross-talk term, i.e., an error in one direction due to the placement of scatterers in the orthogonal direction. It is concluded that this system should not be used.

Pointing error is defined and treated in Chapter 3. Limiting curves of tracking error are given for the various systems in terms of the relative magnitude of the received signal strength. It is pointed out that any method which uses the error signal only when the echo area is relatively large will improve tracking accuracy. Servo-controlling the radar frequency and using a clamping servo are suggested as possible techniques. Examples are given that demonstrate the possibility of increased tracking error of either the amplitude-monopulse system with separated antennas or the phase amplitude-monopulse system.

Modification of an existing echo area measuring system so that the balance point and the echo area can be measured simultaneously is discussed in Chapter 4. Instrumentation and measurement procedures are discussed in detail. Experimental and computed balance-point patterns are compared in Chapter 5. Reasonable agreement is obtained between theory and experiment.

Microfilm $2.00; Xerox $6.60. 139 pages.

EFFECT OF NOISE ON THE FREQUENCY STABILITY OF A REFLEX KLYSTRON

(L. C. Card No. Mic 59-2963)

George Ralston, Ph.D.
Princeton University, 1957

The problem investigated in this dissertation was how does the noise sources in a reflex klystron affect the output frequency. The noise sources in the klystron are the density and velocity fluctuations in the electron beam and the thermal noise of the resonator.

Mechanisms by which the output frequency is varied by the noise are:

1. Cavity susceptance variations due to beam density fluctuations changing the beam loading of the output cavity gap.
2. Electronic susceptance variations due to density fluctuations.
3. Electronic susceptance variations due to velocity fluctuations.
4. Direct excitation of the output cavity by microwave frequency components of shot noise.
5. Variation of cavity susceptance by low frequency shot noise varying the position of the virtual cathode formed in the repeller-anode space as the beam turns around. The mechanism is shown for the first time in this dissertation to be a method by which tube noise can cause the output frequency to vary.

In the dissertation, these methods by which the noise changes the output frequency of the reflex klystron are analyzed quantitatively. It is shown that the major cause of the frequency deviation of the reflex klystron is the variation of the position of the virtual cathode by the low frequency fluctuations of beam current density. At the center of the mode, the virtual cathode position variation produces about 100 times the frequency deviation as any other cause. The behavior of the frequency deviation variation within the mode, from mode to mode, and for different operating conditions is explained by the virtual cathode movement. The theoretical results agree well with the experimentally measured values of frequency deviation.

Since the predominant cause of frequency deviation due to noise in the reflex klystron is the frequency modulation of low frequency noise on the output frequency, the range of detected modulating frequencies is restricted by the half bandwidth of the klystron cavity. The detected frequency deviation exhibits a rise at frequencies below 10 Kcs because flicker effect increases the variation of current above the full shot noise value.

The variation of the output microwave frequency by the low frequency components of beam current noise is peculiar to the reflex klystron. This type klystron has the beam slowing down to zero velocity in the repeller space so that a virtual cathode can be formed.

The detected frequency deviation of the reflex klystron is related to the bandwidth of the measuring system. The frequency deviation at the center of the mode of the reflex klystron is 0.6 cps/cps. Reducing the beam voltage decreases the detected frequency deviation. The frequency deviation is minimum for the lowest modes (most negative repeller voltage) and at the center of the mode.

Microfilm $2.25; Xerox $8.00. 171 pages.

LONG WAVE SWEEP-FREQUENCY INVESTIGATION OF THE LOWER IONOSPHERE AT VERTICAL INCIDENCE

(L. C. Card No. Mic 59-2914)

Chalmers F. Sechrist, Jr., Ph.D.
The Pennsylvania State University, 1959

A wide-band transmitting antenna system design consisting of collinear, terminated transmission lines and the complete low frequency sweep transmitter, receiving and recording instrumentation are described in detail. The experimental apparatus is used to sound the ionospheric regions at vertical incidence with the result that virtual or group height versus frequency data are obtained at 15 minute intervals, in the frequency range from about 100 kc/s to 1 mc/s.

The theoretical considerations begin with a study of the physical theories applicable to the propagation of ionospherically reflected long radio waves having frequencies less than the gyromagnetic frequency. After reviewing the theoretical and experimental results pertaining to characteristics of 150 kc/s reflected waves, it is possible to state some theoretical implications concerning the expected characteristics of group height versus frequency data in the frequency range from 100 kc/s to 1 mc/s. With this theoretical background, the experimental data are examined for a stable night and two magnetically disturbed nights. The experimental data for the stable night reveal a fairly constant group height as a function of frequency, unequal main echo component amplitudes received on crossed dipole antennas below 600 kc/s, splitting of the main reflected echo pulse which is manifested by a downward extension of the main reflected echo near 500 kc/s, and nearly equal echo component amplitudes received on crossed dipole antennas above 600 kc/s.

The experimental data for the magnetically disturbed nights reveal strong interference from atmospheric noise and broadcast stations, spread or diffuse reflections, retardation cusps near 700 kc/s, sudden jumps from one reflecting level to another, other irregular behavior of the reflections, blanketing type and transparent type sporadic layers near 100 km and 160 km respectively, and a possible blanketing type sporadic layer near 180 km.

It is concluded that, for the stable night of August 10-11, 1958, the bottom of the E-layer had a steep gradient of electron density, the main reflection echo polarization was non-circular below about 600 kc/s, the lower portion of a split echo was a possible coupling echo, and the received echoes above 600 kc/s probably had circular wave polarization. The experimentally observed non-circular main echo polarization near 500 kc/s may be explained by the computation of the approximate 500 kc/s main echo polarization assuming plausible electron density and collision frequency models of the lower ionosphere.

It is concluded that, for the magnetically disturbed nights of June 9-10 and June 10-11, 1958, the behavior of sporadic reflections is very erratic; different types of sporadic layers may exist simultaneously at different heights; the non-deviative absorption in the lower ionosphere was lower than normal; the normal E-region electron density had decayed; there was vertical drift present in the E-region in addition to irregularities; in addition to the normal E-layer there existed sporadic layers; the sporadic layer observed on the night of June 9, 1958 was probably below the height of maximum electron density of the normal E-layer; and there was a close correlation between the appearance of sporadic reflections and enhanced geomagnetic activity.

Microfilm $2.95; Xerox $10.20. 227 pages.

SOME PROPERTIES OF ELECTROMAGNETIC FIELDS IN INHOMOGENEOUS ANISOTROPIC MEDIA

(L. C. Card No. Mic 59-2675)

Alfred Thomas Villeneuve, Ph.D.
Syracuse University, 1959

Media characterized by unsymmetrical tensor permeabilities or permittivities are termed non-reciprocal because the usual form of the reciprocity theorem does not apply to them. A modified reciprocity theorem does apply, however, in which media characterized by transposed tensor permeabilities and permittivities are employed. Some of the consequences of this modified reciprocity theorem are considered. Admittance, impedance, and scattering matrices of networks containing linear anisotropic media are transposed when $[\mu]$ and $[\epsilon]$ are transposed. Various consequences of this are stated. Orthogonality relationships for modes in uniform waveguides are derived and energy relationships for waveguide modes are considered.

The modified reciprocity theorem is used in deriving a variational principle applicable to inhomogeneous, anisotropic media. Stationary expressions for resonant frequencies of cavities and propagation constants of waveguides are derived from this variational principle. Several examples of their use are included. A stationary expression for the electromagnetic field scattered by conducting obstacles in the presence of anisotropic media is also derived. A modified Green's function technique, applicable to anisotropic media, is discussed. The correct Green's function is that for media with tensor permeabilities and permittivities transposed.

Microfilm $2.00; Xerox $4.60. 89 pages.

INTERPRETATION OF SOME BACKSCATTER ECHOES IN TERMS OF FIELD-ALIGNED IRREGULARITIES IN THE F REGION

(L. C. Card No. Mic 59-2960)

Paul Franklin Weaver, Jr., Ph.D.
Cornell University, 1959

Long-range radar echoes at 14 Mc/sec which seem to be explicable in terms of direct backscatter from field-aligned irregularities in the F region of the ionosphere have been under study at Ithaca, N. Y. since April, 1955. These echoes were regularly observable during the evening hours with a high power pulsed transmitter and a rhombic antenna beamed toward the north. A typical echo was spread in range from about 1000 km to about 2000 km and had a fading rate comparable to that of auroral echoes observed at the same frequency. Although

Ottawa is located some 500 km south of the region from which these echoes come, analysis of Ottawa ionospheric sounder data established a correlation between the occurrence of "spread F" there and the occurrence of the fast-fade echoes seen from Ithaca.

Azimuth and vertical angles of arrival were obtained by a direction-finding system using antennas with overlapping polar diagrams; the ratios of the antenna signals were measured by a capacitance goniometer and receiver. These measurements placed the apparent points of reflection in the F region. At no time were the fast-fade echoes observed coming from an aximuth other than north, although slow-fade ground scatter was observed coming from various directions.

Because of the observed aspect sensitivity of the echoes, contours of the angle between a plane perpendicular to the earth's magnetic field and ray paths from Ithaca were calculated for F-region heights. These contours of off-perpendicular angle indicated that the observed echoes were coming from an area of near-perpendicularity where angles as low as 9^0 were found.

Because of refraction in the F region, all northward ray paths from Ithaca which would be "reflected" back to earth are bent into perpendicularity at some point along their trajectory. The assumption is therefore made that the observed echoes arise from backscattering by irregularities in the F region elongated along the earth's magnetic field. Calculations on this basis, allowing for refraction and delay time in the F region, lead to echoes at about the observed range.

Microfilm $2.00; Xerox $4.80. 93 pages.

AN INVESTIGATION OF THE MAGNETRON AMPLIFIER

(L. C. Card No. Mic 59-2829)

Brice Alan Wightman, Ph.D.
Stanford University, 1959

The magnetron amplifier is investigated on account of its promise of efficiencies in excess of fifty percent. Two problems are dealt with: First, an analytical investigation of the interaction at small signal levels. Second, an experimental effort to adapt the zig-zag line for the higher power requirements in the magnetron amplifier.

The model for the space-charge effects postulated by Heffner and Unotoro is inserted into the Pierce analysis of the magnetron amplifier. The result includes a determinantal equation for the space-charge-wave interaction which is the same as Gould's, but the analysis embraces all interactions. These interactions are examined with respect to the energy exchange between beam and circuit in order to determine which interactions are useful. Some new and different conclusions are drawn. Calculated values of the roots of the determinantal equation and the initial loss are given. Many consequences and interpretations are derived from the theory such as a determination of the optimum beam position, the effect of space charge in the attenuator, the question of efficiency versus gain, and the effect of space charge on the form of the beam modulation.

The selection of a slow-wave circuit for the magnetron amplifier is discussed, and the zig-zag line is chosen for its low dispersion. This circuit was adapted for higher powers by mounting on a ceramic of high thermal conductivity which was undercut to minimize dielectric loading. The circuit was successfully fabricated by an impact-grinding technique, and the thermal capacity was satisfactory. However, the effect of the undercutting was not as great as anticipated; the coupling impedance was reduced and the attenuation increased excessively for a high-efficiency application. An experimental amplifier using this circuit had an efficiency of only twelve percent. Some alternative proposals for a circuit are made in the light of the results obtained.

Some contributions are made to the experimental technique of observing beams by their gaseous discharge, including a demonstration of the validity of this method.

Microfilm $2.00; Xerox $5.20. 101 pages.

ENGINEERING, HYDRAULIC

TOTAL SEDIMENT TRANSPORT IN ALLUVIAL CHANNELS

(L. C. Card No. Mic 59-2760)

Ramachandra J. Garde, Ph.D.
Colorado State University, 1959

The determination of total sediment transport rate of an alluvial channel, under given flow, fluid and sediment characteristics, is important from the standpoint of hydraulic engineers. In this dissertation, a method of computing the total sediment transport rate by adding suspended-load to bed-load is investigated. The analysis is carried out by using the data collected by United States Geological Survey at Fort Collins in a 150 ft x 8 ft x 2 ft flume with 0.45 mm diameter sediment, plus other data available in literature.

It is shown that all the existing bed-load equations can be put in the form

$$\frac{q_B}{V_* \gamma_s d} = f\left(\frac{\tau_o}{(\gamma_s - \gamma_f)d}\right) \qquad (1)$$

in which

q_B is the rate of bed load transport in lb/sec/ft,

V_* is the shear velocity,

γ_s and γ_f are the specific weights of sediment and water respectively, and

τ_o is the average shear stress on the bed.

Importance of bed condition and its effect on the rate of bed load transport are discussed and a functional relationship for computing the bed-load transport rate in the dune-regime is developed.

It is shown that the most suitable law to describe the velocity distribution in alluvial channels is of the form

$$\frac{v}{V_*} = \frac{2.3}{k} \log_{10}\left(\frac{y}{K_s'}\right) \qquad (2)$$

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

in which

v is the velocity at a distance y above the bed,

k is a dimensionless constant

K_s' is some length parameter

The terms k and K_s' are related to sediment, flow and fluid characteristics.

In order to compute the concentration distribution in the vertical, the sediment distribution equation

$$\frac{c}{c_a} = \left(\frac{D-y}{y} \cdot \frac{a}{D-a}\right)^{Z_1}, \quad (3)$$

is used. In the above equation,

c and c_a are the suspended sediment concentrations at distances y and a from the bed

D is the depth of flow, and

Z_1 is the exponent of sediment distribution equation.

The theoretical value of Z_1, should be

$$Z_o = \frac{w_o}{V_* k_o} \quad (4)$$

in which

w_o is the fall velocity of sediment, and

k_o is Karman constant (= 0.4).

Methods have been established to predict c_a and Z_1.

Finally, in order to compute the total suspended-load, a procedure for integrating (concentration x velocity) curve over the depth of flow is suggested.

In order to predict the regime of flow for given conditions of flow, fluid, and sediment the existing criteria are studied and a new criterion is proposed.

Microfilm $2.00; Xerox $6.40. 134 pages.

ENGINEERING, MECHANICAL

TEMPERATURE DETERMINATIONS OF NITROGEN AND METHANE-AIR COMBUSTION PRODUCTS BY VELOCITY-OF-SOUND MEASUREMENTS

(L. C. Card No. Mic 59-2569)

Vito Dante Agosta, Ph.D.
Columbia University, 1959

For systems not in complete thermodynamic equilibrium, a pseudotemperature is defined as that temperature which prevails in the translational states. This assumes: (1) that the translational states are in thermal equilibrium among themselves; and (2) that the energy content of the gas, if all the other energy states were in equilibrium with the translational states, would not differ by a substantial amount from the actual energy of the gas. The velocity of sound was selected as a characteristic quantity related to the thermodynamic state of a gas. A device was designed and built capable of measuring the velocity of sound both in nonreacting and in reacting gases, and thereby provided a means of determining the temperature of a gas. For nitrogen in equilibrium in the range $530^\circ R \leq T \leq 856^\circ R$ temperatures calculated from velocity-of-sound measurements agreed to within one per cent of those measured by a thermocouple.

For the combustion products of a stoichiometric mixture of methane and air, two series of tests were run. In the first series of tests for stoichiometric mixtures of methane and air, the temperature determined by velocity-of-sound measurements was shown to be within $10^\circ R$ and deviate not more than $320^\circ R$ from the adiabatic flame temperature of $4708^\circ R$. In the second series of tests, the pressure history of the reacting mixture was obtained, and the temperature was determined therefrom. Calculated temperatures by the velocity-of-sound and equation-of-state methods deviated by not more than $235^\circ R$ in $3300^\circ R$. For both of these combustion runs, the weighted average temperature of the gases differed from the adiabatic flame temperature due to compression effects in the gases and heat transfer from the gases to the heat chamber wall during combustion. Both of these effects suffice to account for these discrepancies.

Microfilm $3.65; Xerox $12.40. 282 pages.

THE EFFECT OF TURBULENT DIFFUSION ON FLAME STABILIZATION

(L. C. Card No. Mic 59-203)

P. Roy Choudhury, Ph.D.
Northwestern University, 1958

Supervisor: Dr. Ali Bulent Cambel

This dissertation is a study of the criterion of lean blow-off based on a turbulent mass transport hypothesis. The basic premise of the hypothesis is that the overall turbulent mass transfer rate ($\dot{m}$) of the combustible across the flame front equals the rate of consumption ($\dot{m}$) at the time of lean blow-off. Arrhenius' equation is used to calculate the reaction rate and the rate of consumption of the combustible is calculated by integrating the reaction rate over the volume of the luminous zone.

The hypothesis is applied to two simplified models, namely, a recessed wall and an opposing jet flameholder. The predicted values of blow-off velocity agree fairly well with the experimental results reported by other investigators. It is found that the effect of turbulent diffusion is small compared to the convective mass transfer.

The analysis leads to a Damköhler type of similarity parameter $u_n/K\delta$. The values of this parameter are 0.9 and 0.99 for the recessed wall and the opposing jet flameholders, respectively. The parameter is identically equal to unity if the mass transfer due to turbulent diffusion is neglected.

For the recessed wall flameholder, blow-off velocities are calculated directly from the parameter. Since the estimation of the luminous zone thickness, δ, is not possible from the present photographic study of an opposing jet, a graphical procedure is set up for the solution of the equation containing the similarity parameter. Lean blow-off velocities are predicted from this graphical procedure.

Even though this study is restricted to lean blow-off

only, a criterion of rich blow-off can be obtained by a similar approach where oxygen is the species under investigation. Microfilm $2.00; Xerox $4.20. 78 pages.

A THEORY FOR CUMULATIVE FATIGUE DAMAGE IN METALS

(L. C. Card No. Mic 59-2737)

Robert Roswell Gatts, Ph.D.
The Ohio State University, 1959

A quantitative theory for the accumulation of fatigue damage is developed which accounts for the effect of variation of stress-amplitude under conditions of fully-reversed, one-dimensional loading. All of the other factors affecting fatigue are isolated from the description of the basic phenomenon. It is assumed that the defining relationships are those corresponding to the average of the group considered, and it is further assumed that the effects of scatter can be superimposed on the resulting evaluations. The problem is approached from a phenomenological point of view. The basic assumptions concern parameters which are familiar to a design engineer, such as stress and cycles, and the theory is completely developed in terms of these quantities.

Published literature pertinent to the development of quantitative mathematical methods for evaluating the accumulation of fatigue damage is reviewed. Experimental evidence is cited to establish the fact that the stress-amplitude associated with any life, including the highest stress-amplitude associated with infinite life (i.e., the endurance limit), is reduced as a consequence of the accumulation of fatigue damage. The following hypotheses are then proposed as the basis of a quantitative cumulative damage theory:

1. The fatigue damage accumulated during any load cycle can be measured uniquely by the difference between the endurance limit before the application of that cycle and the endurance limit after that cycle.
2. The amount of fatigue damage contributed by any cycle is proportional to a power of the amount by which the stress-amplitude exceeds the instantaneous value of the endurance limit.
3. The amount of damage accumulated in one cycle can be considered to represent the rate of change of damage with cycles, where cycles are treated as a continuous independent variable and damage as the dependent variable.
4. The damage done in any cycle during the action of random loading is the expected value of damage for that cycle. (The expected value is defined as the weighted sum of all possible values. Each value is weighted by its associated probability.)

These hypotheses provide the basis for the derivation and application of a differential equation which expresses the rate of change of the endurance limit with cycles of loading as a function of the instantaneous value of the endurance limit and the stress-amplitude. Associated boundary conditions are established and solutions of the differential equation are obtained for constant amplitude, uniformly increasing amplitude, and random amplitude loading.

The resulting expressions are compared with experimental data available in the published literature and with empirical equations which have been found compatible with such data by various investigators. The data considered were obtained by many different investigators on a wide variety of steels and consist principally of the results of rotating-bending tests on smooth, polished specimens with critical sections between one-eighth and one-third of an inch in diameter. A substantial agreement is demonstrated to exist between the data and the theory, and on this basis the suitability of the results of the theory for application to design is considered.

Some of the more important conclusions and results are as follows:

1. A basically phenomenological approach can be used as a basis for more extensive correlation of cumulative damage data than has heretofore been supposed.
2. Composite S-N curves for different steels can be plotted if suitable non-dimensional coordinates are used, i.e., over-stress ratio vs. life ratio.
3. Relationships suitable for design calculations are developed which are in many cases superior to those otherwise available.

Microfilm $2.30; Xerox $8.20. 176 pages.

FILM COOLING OF ROCKET MOTORS: PART I: AN EXPERIMENTAL AND THEORETICAL INVESTIGATION OF FILM COOLING OF ROCKET MOTORS PART II: FILM COOLING, ITS THEORY AND APPLICATIONS

(L. C. Card No. Mic 58-1783)

Alfred Rapp Graham, Ph.D.
Purdue University, 1958

Major Professor: M. J. Zucrow

Experiments on film cooling were conducted with a rocket motor burning WFNA (white fuming nitric acid) and JP-4 (jet engine fuel) at a combustion pressure of 500 psia and at a thrust level of 500 pounds. The flow rates of film coolant required for film cooling different length cylindrical sections with WFNA and JP-4 were determined, and those results were compared to the experimental results previously obtained by Sellers (9) for the case of film cooling with water. An analytical method for calculating the required film coolant flow rate for cooling a given length cylindrical section was devised.

The loss in specific impulse due to film cooling was determined accurately for the case of film cooling with WFNA, JP-4, and water; the experiments indicated that the loss in specific impulse was of the same order of magnitude for each of the film coolants investigated. It was concluded that the film coolant vapors do not react to any large extent with the combustion gases.

It was also demonstrated that large reductions in the nozzle heat flux resulted from film cooling cylindrical sections located directly upstream of the exhaust nozzle.

A film cooled exhaust nozzle was designed by utilizing the results obtained in experiments with cylindrical sections; the film coolant (water) was injected at three stations along the nozzle walls. The required film coolant flow rate, for cooling the afore-mentioned nozzle, was the same as that calculated. It was determined that introducing the film coolant at three stations along the walls of the nozzle, decreased the required film coolant flow rate by at least a factor of 2, compared to introducing all of the film coolant at the entrance section of the nozzle.

Microfilm $5.40; Xerox $19.00. 421 pages.

ANALYTICAL STUDY OF THE ENERGY-WEIGHT AND ENERGY-VOLUME CHARACTERISTICS OF ENERGY STORAGE SYSTEMS

(L. C. Card No. Mic 59-2721)

Leo Virgil Kline, Ph.D.
The Ohio State University, 1954

INTRODUCTION

For most engineering applications, especially those applications which deal with aircraft, increasing emphasis is being placed on conservation of weight and volume. Thus, for an application where an energy storage system is used, it is important for the designer to be able to evaluate the amount of energy which can be extracted from a system per unit of the system's weight and the amount of energy which can be extracted from a system per unit of space occupied by the system. This study is one which evaluates the energy storage capacity per unit weight and per unit volume for various energy storage systems.

In the field of mechanics, the energy storage capacity of a system is defined as the system's ability to do work. The understanding of this definition can be facilitated by an examination of the first law of thermodynamics. This law can be written mathematically as

$$W = Q - \Delta U,$$

where Q, W, and U respectively represent the heat[1] added to the system, the work[2] done by the system, and the internal energy[3] of the system. The above equation indicates that a system's ability to do work is dependent on the amount of heat which crosses the boundaries of the system and on the change in the internal energy of the system. The amount of heat which crosses the boundaries and the change in internal energy are, in turn, dependent on the process which is used for extracting work from the system. Thus, according to the mechanics concept of energy, the energy storage capacity of a system is dependent on the process used to extract work from the system. This is the concept of energy which is used throughout this study.

SUMMARY OF RESULTS

This study has revealed that in order for the designer to select the energy storage system which is best suited to a given application, the relative merits of space and weight conservation must be considered. Thus if the designer selects an energy storage system which has excellent energy-weight characteristics, the system may have only fair energy-volume characteristics. Tables 1 and 2 show the most common energy storage systems in the order of decreasing energy storage capacity per unit weight and per unit volume. The values which are included in these tables are the largest values which are felt to be physically practical.

For any given energy storage means, it should be emphasized that the design which produces the best energy-weight characteristics will not necessarily produce the best energy-volume characteristics. For example, for a uniform stress disk with a rim, the combination of dimensions which produces the maximum energy per unit weight

Table 1

ENERGY STORAGE CAPACITY PER UNIT WEIGHT

System	ft lb/lb
Ag-Zn electrochemical cell	146,000
Lead-acid electrochemical cell	38,000
Edison electrochemical cell	35,000
Uniform stress disk with rim*	27,350
Compressed gas (spherical container)†	22,600
Compressed gas (cylindrical container)‡	18,400
Cylindrical flywheel §	18,000
Rim-arm flywheel ‖	2,450
Compressed liquid (ether)¶	300
Compressed solid (torsion spring)**	29
Compressed solid (spiral-wound spring)††	16
Compressed solid (coil spring)‡‡	15
Compressed solid (Belleville spring)§§	11

* See equations (1), (2), and (3), where $C = 1$, $k = 0.4$, $\rho = 7.31 \times 10^{-4}$ lb sec^2/in^4, and $S_{md} = 100{,}000$ psi.

† See equation (4), where $\gamma = 1.4$, $\rho_c g = 0.283$ lb/in^3, $S_{mc} = 100{,}000$ psi, $T_1 = 520^0$R, $c_v = 134.5$ ft lb/lb-^{0}F, $R = 53.3$ ft lb/lb-^{0}R, $p_o = 6{,}000$ psi, and $p_f = 14.7$ psi. The process is isentropic.

‡ See equation (5), where the constants are as in note †.

§ See equation (6), where $t/r = 0.2$, $\mu = 0.288$, $\rho = 7.31 \times 10^{-4}$ lb sec^2/in^4 and $S_{md} = 100{,}000$ psi.

‖ See equation (7), where $t_r/r_m = 0.3$, $\rho = 7.31 \times 10^{-4}$ lb sec^2/in^4, $n = 8$, and $S_{md} = 25{,}000$ psi. The allowable stress in the rim-arm type flywheel has been chosen lower than in other types of flywheels due to the greater stress concentration in the rim-arm flywheel.

¶ $p_o = 2000$ atm., $p_f = 1$ atm., $L_c/r_{ir} = 10$, $S_{mc} = 100{,}000$ psi, ether is the working medium, and the process is isothermal. See the original work for the combination graphical-analytical solution.

** See equation (8), where $d_i/d_o = 1$, $G = 11.5 \times 10^6$ psi, $\rho = 7.31 \times 10^{-4}$ lb sec^2/in^4, and $S_{ms} = 50{,}000$ psi.

†† See equation (9), where $E = 30 \times 10^6$ psi, $\rho = 7.31 \times 10^{-4}$ lb sec^2/in^4, and $S_{mb} = 50{,}000$ psi.

‡‡ See equation (10), where $G = 11.5 \times 10^6$ psi, $\rho = 7.31 \times 10^{-4}$ lb sec^2/in^4, and $S_{ms} = 50{,}000$ psi.

§§ See equations (11) through (15), where $t/r_2 = 0.1$, $E = 30 \times 10^6$ psi, $\mu = 0.288$, $\rho = 7.31 \times 10^{-4}$ lb sec^2/in^4, $r_1/r_2 = 0.8$ and $S_{mb} = 100{,}000$ psi.

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Table 2

ENERGY STORAGE CAPACITY PER UNIT VOLUME

System	$(\text{ft lb/ft}^3)10^{-3}$
Ag-Zn electrochemical cell	14,800
Uniform stress disk with rim*	9,000
Cylindrical flywheel†	8,750
Compressed gas (spherical container) ‡	5,200
Lead-acid electrochemical cell	5,000
Edison electrochemical cell	4,800
Compressed gas (cylindrical container) §	4,000
Rim-arm flywheel ‖	1,440
Compressed liquid (ether) ¶	90
Compressed solid (torsion spring)**	8
Compressed solid (coil spring) ††	5
Compressed solid (spiral-wound spring) ‡‡	4
Compressed solid (Belleville spring) §§	2

* See equations (16), (17), and (3), where C = 1.5, k = 0.75 and S_{md} = 100,000 psi.

† See equation (18), where t/r = 0.2, μ = 0.288 and S_{md} = 100,000 psi.

‡ See equation (19), where S_{mc} = 100,000 psi, T_1 = 520°R, c_v = 134.5 ft lb/lb-°F, R = 53.3 ft lb/lb-°R, p_o = 30,000 psi, p_f = 14.7 psi. The process is isentropic.

§ See equation (20) where constants are as indicated for note ‡ .

‖ See equation (21), where t_r/r_m = 0.4, S_{md} = 25,000 psi and n = 8. See note ‖ , Table 1, for explanation concerning S_{md}.

¶ L_c/r_{1r} = 10, p_o = 2000 atm., p_f = 1 atm., S_{mc} = 100,000 psi, and the process is isothermal. See the original work for the combination graphical-analytical solution.

** See equation (22), where d_i/d_o = 0.1, G = 11.5 x 10^6 psi and S_{ms} = 50,000 psi.

†† See equation (23), where D/d = 2, G = 11.5 x 10^6 psi and S_{ms} 50,000 psi.

‡‡ See equation (24), where r_a/r_c = 0.1, E = 30 x 10^6 psi and S_{mb} = 100,000 psi.

§§ See equations (25), (12) and (15), where t/r_2 = 0.1, r_1/r_2 = 0.625, μ = 0.288, E = 30 x 10^6 psi and S_{mb} = 100,000 psi.

is not the combination of dimensions which produces the maximum energy per unit volume.

For applications where it is unnecessary to extract energy from a system more rapidly than it can be extracted from a Ag-Zn electrochemical cell, this cell is the best of the energy storage systems which have been considered in this study. Generally, electrochemical cells have better energy-weight characteristics than the other energy storage systems which have been considered.

For applications where it is necessary to extract energy from a system more rapidly than it can be extracted from an electrochemical cell, the uniform stress disk with a rim is the best of the energy storage systems considered.

If it is desired to store energy for a longer period of time than is practical in a flywheel, and it is necessary to extract energy from the system more rapidly than it can be extracted from an electrochemical cell, then a compressed gas energy storage system is best. A compressed-gas storage system which utilizes a spherical container is superior to a system which utilizes a cylindrical container.

Although springs are one of the most commonly used means of storing energy, they are the poorest of the means which have been considered.

The magnitudes of the energy storage capacity per unit weight and per unit volume for a compressed liquid system are approximately 10 times greater than the magnitudes for a spring system.

In addition to the general conclusions which have been arrived at on the basis of this study, the study is of value as a source of basic information relating to energy storage systems. For each energy storage system which has been considered, generalized equations have been developed for the energy storage capacity per unit weight and per unit volume. In addition, many graphs which are pictorial representations of the analytical energy-weight and energy-volume relations have been included.

The dissertation to which this abstract refers is 146 pages long, contains 270 equations, 33 graphs, and 5 tables of numerical results.

EQUATIONS

(1) $$E_f = 4\pi S_{md} x_1 r_{1r}^2 \{[1 - e^{-\Omega}(1+\Omega)][1/4\Omega] + Ck\Omega e^{-\Omega}(1 + k/2)(1 + k + k^2/2)/2\}$$

(2) $$W_f = r_{1r}^2 x_1 \pi \rho [Ce^{-\Omega}(2k + k^2) + (1 - e^{-\Omega})/\Omega]/g$$

(3) $$\Omega = 2\{1 + 1/(1+k)^2 + [1 - 1/(1-k)^2][(1-\mu)C + \mu]\}/C\{[(k+1)^2 - 1][(3+\mu) + (1-\mu)/(1+k)^2]\}$$

(4) $$E_g/W_t = (c_v p_o/R)[1 - (p_f/p_o)^{(\gamma-1)/\gamma}]/\{p_o/RT_1 + \rho_c g(3p_o/2S_{mc})/(1 - 3p_o/2S_{mc})\}$$

(5) $$E_g/W_t = (p_o c_v/R)[1 - (p_f/p_o)^{(\gamma-1)/\gamma}]/\{(p_o/RT_1) + g\rho_c[(2p_o/S_{mc})/(1 - 2p_o/S_{mc})]\}$$

(6) $$E_f/W_f = 2S_{md}/\rho g[3 + \mu + \mu(1+\mu)(t/r)^2/3(1-\mu)]$$

(7) $$E_f/W_f = S_{md}/3\rho g\,(0.75 + \pi^2 r_m/2n^2 t_r)$$

(8) $$E_s/W_s = S_{ms}^2[1 + (d_i/d_o)^2]/4\rho gG$$

(9) $$E_s/W_s = S_{mb}^2/6g\rho E$$

(10) $$E_s/W_s = S_{ms}^2/4gG\rho$$

(11) $$E_s/W_s = (t/r_2)^4 E(h/t)^2[(h/t)^2 + 4]/8g(1-\mu^2)\pi\rho C_3[1 - (r_1/r_2)^2]$$

(12) $$(h/t) = C_2\{[1 + 2S_{mb}(1-\mu^2)C_3 C_1(r_2/t)^2/EC_2^2]^{1/2} - 1\}/C_1$$

(13) $$C_1 = 6[(\beta-1)/\ln\beta - 1]/\pi \ln\beta$$

(14) $$C_2 = 6[(\beta-1)/2]/\pi \ln\beta$$

(15) $$C_3 = 6[(\beta-1)/\beta]^2/\pi \ln\beta$$

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(16) $E_f/V_f = 2S_{md}\{[1 - e^{-\Omega}(1+\Omega)]/2\Omega + Ck\Omega e^{-\Omega}(1 + k/2)(1 + k + k^2/2)\}/(1+k)^2 \quad b<x_1$

(17) $E_f/V_f = 2S_{md}\{[1 - e^{-\Omega}(1+\Omega)]/2\Omega + Ck\Omega e^{-\Omega}(1 + k/2)(1 + k + k^2/2)\}/(1+k)^2 C e^{-\Omega} \quad b>x_1$

(18) $E_f/V_f = 2S_{md}/[3 + \mu + \mu(1+\mu)(t/r)^2/3(1-\mu)]$

(19) $E_g/V_c = (p_o c_v/R)[1 - (p_f/p_o)^{(\gamma-1)/\gamma}][1 - 3p_o/2S_{mc}]$

(20) $E_g/V_c = (p_o c_v/R)[1 - (p_f/p_o)^{(\gamma-1)/\gamma}][1 - 2p_o/S_{mc}]$

(21) $E_f/V_f = S_{md}/(r_m/t_r)(0.75 + \pi^2 r_m/2n^2 t_r)$

(22) $E_s/V_s = S_{ms}^2[1 - (d_i/d_o)^4]/4G$

(23) $E_s/V_s = S_{ms}^2 \pi/4(D/d)[(D/d)^2 + 2(D/d) + 1][G(d/D)^2 + S_{ms}\pi]$

(24) $E_s/V_s = S_{mb}^2[1 - (r_a/r_c)^2]/12E$

(25) $E_s/V_s = E(t/r_2)^4(h/t)^2[(h/t)^2 + 4]/8(1-\mu^2) C_3\pi(h/t + 1)$

NOMENCLATURE

b width of flywheel rim measured along an axis which is parallel to the axis of rotation

c_v specific heat at constant volume

C ratio of rim thickness (measured parallel to axis of rotation) to disk thickness (measured at point where disk and rim are connected)

C_1 see equation (13)

C_2 see equation (14)

C_3 see equation (15)

d wire diameter of coil spring

d_i inside diameter of hollow torsion bar

d_o outside diameter of hollow torsion bar

D mean diameter of coil spring

e constant (base of natural logarithms) = 2.718

E modulus of elasticity

E_f energy storage capacity of flywheel

E_g energy storage capacity of gas

E_s energy storage capacity of spring

F Fahrenheit

g constant equal to acceleration of freely falling body

G modulus of rigidity

h over-all height of Belleville type spring

k dimension function = $(r_{2r} - r_{1r})/r_{1r}$

L_c length of cylindrical portion of container for a cylindrical container with hemispherical ends

n number of arms in rim-arm flywheel

p_f pressure after expansion has occurred

p_o pressure before expansion occurs

r radius

r_a radius of arbor on which spiral type spring is wound

r_c radius of casing which contains spiral-wound spring

r_m mean radius of rim in rim-arm type flywheel

r_1 inside radius of Belleville type spring

r_2 outside radius of Belleville type spring

r_{1r} inside radius of rim or inside radius of container

r_{2r} outside radius of rim

R universal gas constant or Rankine

S_{mb} maximum bending stress

S_{mc} maximum direct stress in container

S_{md} maximum direct stress

S_{ms} maximum shearing stress

t thickness

t_r thickness of rim measured perpendicular to axis of rotation

T_1 temperature before expansion occurs

V_c volume of space occupied by container

V_f volume of space occupied by flysheel

W_f weight of flywheel

W_s weight of spring

W_t total weight of system

x_1 thickness of uniform stress disk at zero radius

OC see equation (3)

β radius ratio = r_1/r_2

γ ratio of specific heat at constant pressure to specific heat at constant volume

μ Poisson's ratio

ρ density

ρ_c density of container material

Microfilm $2.05; Xerox $7.20. 154 pages.

1. Heat can be defined as energy transferred, without transfer of mass, across the boundary of a system because of a temperature difference between system and surroundings.

2. Work can be defined as energy transferred, without transfer of mass, across the boundary of a system because of an intensive property difference other than temperature that exists between system and surroundings.

3. Internal energy can be defined as any energy other than heat or work. This energy can be considered as any energy stored within a system.

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DROPWISE CONDENSATION ON A LONG VERTICAL PIPE

(L. C. Card No. Mic 59-2417)

Joseph Toa Seng Ma, Ph.D.
Iowa State College, 1959

Supervisors: Henry M. Black and Glenn Murphy

Film heat transfer coefficients of dropwise condensation under vacuum have been determined for saturated steam on a vertical 10-ft long, $2\frac{3}{8}$ in. diameter, copper-plated nickel pipe. The condensing pressures varied from 4.40 to 27.63 in. Hg abs. The heat loads varied from 1,170 to 19,700 Btu hr^{-1} ft^{-2}. The mechanism of dropwise condensation was also investigated. Observation of the entire condensing surface was possible since the nickel pipe was housed in a concentric Pyrex glass pipe, six inches in diameter. Still and motion pictures were taken at two places on the condensing surface where the phenomena of dropwise condensation is distinctively different.

The cooling fluid used was saturated liquid Freon-11, and it was possible to obtain a uniform cooling temperature throughout the entire length of the pipe. Benzyl mercaptan was injected into the steam as a promoter for inducing dropwise condensation. Injection of mercaptan into the steam proved to be a practical method, since the promoter is continuously replenished.

Heat transfer coefficients were found to increase linearly with increasing pressure and heat load. However, they decreased as the height of the condensing surface increased. A theoretical derivation was made of the effect of condensing surface height on the average heat transfer coefficient. It indicated that the heat transfer coefficient should decrease with increasing height of the condensing surface.

Heat transfer coefficients obtained by dropwise condensation are higher than in other modes of condensation. This is true if the condensing surface is not high, or if some means are provided for the removal of condensate streams from the lower portion of the condensing surface.

Microfilm $2.15; Xerox $7.60. 162 pages.

SPRAY DRYING OF SERRATIA MARCESCENS, A BACTERIA. (A report prepared by Howard Albert McLain as a supplement to the thesis entitled DEVELOPMENT OF A HIGH VELOCITY SPRAY DRYER by Howard Albert McLain).*

(Publication No. 18,716)
(A SUPPLEMENT)

Howard Albert McLain, Ph.D.
Purdue University, 1956

Major Professor: Professor E. W. Comings

Serratia marcescens suspensions were successfully dried by the high velocity spray dryer using a variety of operating conditions. A product with a high percentage of viable cells was obtained in the form of small spherical solid particles. Particle size distribution was determined for the product of one run with a Millipore filter. This size distribution was found to follow the log normal distribution function with a geometric volume mean diameter of 5.1 microns and a geometric mean deviation of 1.6. Moisture content of the dried product varied from 4 to 8 percent.

The dryer was operated successfully with primary air temperatures up to 700°F and feed rates up to 5.0 gal/hr. Primary air temperatures below 400°F failed to give satisfactory drying of the sprayed material. Heat requirements as low as 2000 B.t.u. per pound of evaporated water have been realized for runs with satisfactory drying. A statistical analysis of the results was made to determine the relationship between dryer operating variables and percentage viable recovery. Only a small percentage of the variation in results appears to be attributable to dryer performance.

Storage tests were made on the dried product collected in bag filters. Material stored in sealed vacuum vials had a higher half life than that stored in sealed nitrogen-filled vials or in sealed air-filled vials. Lower storage temperatures increased the half life of the spray dried product.

Microfilm $2.00; Xerox $5.20. 105 pages. Mic 59-3160.

*This is a supplement to the original thesis entitled DEVELOPMENT OF A HIGH VELOCITY SPRAY DRYER, Pub. No. 18,716, 248 pp. $3.20. Published in Dissertation Abstracts, Vol. XVI, No. 10, pp. 1872-1873, 1956. Mic 56-2976.

THE EXPERIMENTAL AND ANALYTICAL DETERMINATION OF THE HEAT TRANSFER CHARACTERISTICS OF AIR AND CARBON DIOXIDE IN THE THERMAL ENTRANCE REGION OF A SMOOTH TUBE WITH LARGE TEMPERATURE DIFFERENCES BETWEEN THE GAS AND THE TUBE WALL

(L. C. Card No. Mic 58-3209)

Helmut Wolf, Ph.D.
Purdue University, 1958

Major Professor: Dr. M. J. Zucrow

Part I

Heat transfer experiments have been conducted under conditions of heating and cooling air and carbon dioxide in turbulent flow in smooth round tubes with a fully established velocity profile and a uniform temperature profile at the entrance to the test section. Local and average values of the heat transfer and flow parameters were calculated from data obtained during the heating and cooling experiments.

The cooling experiments utilizing air and carbon dioxide as the heat transfer medium were conducted over bulk Reynolds numbers ranging from 16,870 to 218,700 for conditions of (a) wall temperature invariant with axial distance, (b) a linear decrease in wall temperature with axial distance, and (c) a linear increase in wall temperature with axial distance. The results obtained with the wall temperature invariant with axial distance demonstrated that for a given wall temperature and bulk Reynolds

number the average bulk temperature of the gas in the test section had no effect upon the average bulk Nusselt number when the properties were evaluated at the average bulk temperature. The average heat transfer results for cooling air and carbon dioxide with wall temperatures (invariant with axial distance) ranging from 544 to 1227 R, inlet bulk temperatures from 651 to 2240 R, static pressures from 49.5 to 354.0 psia in a test section having L/D = 60.4, were correlated with an average deviation of ± 3.5 per cent by the following equations:

$$\overline{Nu}_b = 0.0202\ \overline{N}_{Reb}^{0.8}\ \overline{N}_{Pr}^{1/3}$$

$$\overline{j}_b = 0.0202\ \overline{N}_{Reb}^{-0.2}$$

Where the physical properties were evaluated at the average bulk temperature of the fluid in the test section. Evaluation of the physical properties at temperatures other than the bulk temperature increased the deviation of the results from the correlating line.

At a given bulk Reynolds number the results obtained with a linear decrease in wall temperature with axial distance yielded a significant increase, of the order of 20 per cent, in the average bulk Nusselt number over that obtained with the wall temperature invariant with axial distance. The experiments with a linear increase in wall temperature with distance yielded slightly lower values for the average Nusselt number as compared to those obtained with the wall temperature invariant with axial distance. The results obtained with variable wall temperature were brought into agreement with those obtained at constant wall temperature ($\partial T_w/\partial x = 0$) by employing a modified form of the theory developed by Rubesin (1)*.

The heating experiments utilizing air and carbon dioxide as the heat transfer media were conducted in test sections having L/D = 21, 40, and 60 for film Reynolds numbers ranging from 33,400 to 212,740, average wall temperature 621 to 1782 R, average bulk temperature 545 to 803 R at a static pressure of 100 psia. The results for heating air and carbon dioxide were correlated with an average deviation of ± 2.5 per cent by the following equation.

$$\overline{j}_f = 0.0406\ \overline{N}_{Ref}^{-0.2}\ (\overline{T}_w/\overline{T}_b)^{0.55}\ (L/D)^{-0.15}$$

Where the physical properties were evaluated at the average film temperature of the gas; evaluation of the properties at other temperatures did not improve the correlation.

The values of the local bulk Nusselt number continued to decrease with axial distance when the gas was heated; however, when the gas was cooled the local Nusselt number first decreased then increased with axial distance. Values of the thermal entrance length were determined as a function of Reynolds number for the case of heating and cooling air and carbon dioxide from the variation of the local heat transfer coefficient with axial distance over the above-mentioned range of variables. For heating air and carbon dioxide, one per cent thermal entrance lengths ranging from 11 to 27 diameters were obtained over the range of bulk Reynolds numbers from 50,000 to 246,000. For the case where air and carbon dioxide were cooled with $\partial T_w/\partial x = 0$, thermal entrance lengths ranging from 12 to 26 diameters were obtained for the range of bulk Reynolds numbers from 23,000 to 218,000.

The predicted values of Nusselt number and the entrance lengths are compared with those obtained experimentally. The experimental results are presented in tabular and also in graphical form.

Part II

The mathematical description of flow with heat transfer is presented for a fluid flowing through a circular duct of constant area, under laminar and turbulent flow conditions. A review of the published literature is included that summarizes the analytical work pertinent to the calculation of heat transfer in the entrance region. A calculation of the heat transfer characteristics for air and carbon dioxide in the entrance region has been made employing the boundary layer equations of Eckert (2) that were non-dimensionalized according to the method of Deissler (3). The calculations were performed for the boundary conditions of constant heat flux (heating the gas), and constant wall temperature (cooling the gas); it was assumed that the velocity profile was fully developed and the temperature profile was uniform at the cross section where energy exchange was initiated. Local values of the Nusselt number and friction coefficient were calculated at nominal values of Reynolds number. The results indicate that the intensity of heating or cooling causes a much larger change in the local Nusselt number for air than for carbon dioxide, under similar conditions of flow at a given axial position. The calculated values of the friction coefficient in the presence of heat transfer did not vary appreciably with axial distance. Values of the thermal entrance length were computed as a function of the Reynolds number. The computed results are presented in tabular and in graphical form.

Microfilm $7.90; Xerox $27.20. 621 pages.

*Numbers in parentheses refer to the numbered references in the Bibliography.

ENGINEERING MECHANICS

THERMOELASTIC STRESSES IN BEAMS

(L. C. Card No. Mic 59-2571)

Euval S. Barrekette, Ph.D.
Columbia University, 1959

An analytical successive-approximation method for the solution of linear partial differential equations is applied to the solution for thermoelastic stresses and displacements in free beams of arbitrary constant cross section subjected to arbitrary temperature distributions. The stresses and displacements are obtained in terms of series, the n-th terms of which are of the form $\beta^n \mathfrak{L}_n(\partial^n T/\partial \bar{x}^n)$ where β is the ratio of the maximum linear dimension of the cross section to the length of the beam, T is the temperature, $\bar{x}$ is the ratio of the axial coordinate to the length of the beam and $\mathfrak{L}_n$ is a homogeneous linear integral differential operator in y and z only. The first term of the series for the normal axial stress is, when Poisson's ratio is zero, identical with the solution based on a strength-of-materials analysis, and the first term of the series for the axial displacement leaves plane sections plane. The leading terms of the series provide good approximations when the temperature can be expanded in a rapidly convergent power series and in long bars ($\beta \ll 1$). The case of an axisymmetric temperature distribution in

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

beams of constant circular cross section is examined in detail and a numerical example for the case of temperatures varying only with the axial coordinate is presented. The first two terms of the expansions of all stress components in a right circular cylindrical beam under an arbitrary temperature distribution are given in integrated form. The stress compatibility equations in cylindrical coordinates are derived explicitly in an Appendix.

Microfilm $2.00; Xerox $5.80. 115 pages.

A THEORY OF SMALL DEFORMATIONS OF SOLID BODIES

(L. C. Card No. Mic 59-2810)

Johannes Ferdinand Besseling, Ph.D.
Stanford University, 1959

An attempt is made to present a theory that is capable of giving a mathematical description of the following phenomena observed in the deformation and heating of solid bodies: thermal stresses, thermo-elastic damping of vibrations, dynamic and static moduli, Bauschinger effect and other anisotropic hardening phenomena in plastic deformation, primary creep preceding the secondary stage of steady creep under constant stress, creep recovery and stress relaxation.

For all materials with a coefficient of thermal expansion unequal to zero, heating and cooling is coupled with deformation and vice versa. Since heat flow by conduction is an irreversible process, the theory of elasticity which is based on the concept of reversibility can be rigorously valid only under special conditions, such as stationary states of deformation, provided no creep or plastic deformation has taken place. When these conditions are not fulfilled in a rigorous analysis, the theory of elasticity must be replaced by the theory of thermo-elasticity if the difference between the internal energy in the deformed state and in a fixed reference state is a function only of the geometrical measures of deformation and the temperature differences with respect to the reference state.

All materials are inhomogeneous on a microscopic scale. In thermo-elastic deformation the distribution of the elastic energy on a microscopic scale is irrelevant to the macroscopic deformation problem, since this distribution is independent of the path of deformation. This makes it possible to replace a material that is inhomogeneous on a microscopic scale by a fictitious homogeneous continuum that will exhibit the same behavior with respect to the gross variables of state as the actual material. In inelastic deformation the dissipation of mechanical energy into heat cannot in general be replaced by the dissipation of energy in a homogeneous continuum since it is intimately connected with the distribution of elastic energy on a microscopic scale.

A theory is presented in which the inhomogenities of the material on a microscopic scale are taken into account by considering an element of volume to be composed of various portions which can be represented by subelements showing secondary creep and isotropic work hardening in plastic deformation. The inelastic strains of the subelements play the role of deformation parameters describing the history of the deformation process. They define locked-in stresses on a microscopic scale which in this theory are solely responsible for the anisotropic phenomena (Bauschinger effect) and creep recovery.

The variational principles of thermo-elasticity, creep and of the theories of plasticity are all derived from one thermodynamic variational principle which is formulated with the aid of the entropy displacement field introduced by Biot. In contrast to the work of Biot the entropy is here considered to be composed of two parts: the entropy produced by irreversible processes and the entropy derivable from the entropy displacement field.

Thermo-elastic damping of bending vibrations of beams and creep damping of pure shear vibrations are considered in some detail. Microfilm $2.00; Xerox $5.60. 113 pages.

A GENERAL COMPLEX-NUMBER METHOD FOR PLANE KINEMATIC SYNTHESIS WITH APPLICATIONS

(L. C. Card No. Mic 59-2596)

George N. Sandor, Eng.Sc.D.
Columbia University, 1959

Plane mechanisms with lower-pair connections, as well as certain geared and cam-connected linkages, can be represented by a general chain consisting of consecutively connected bar-slider pairs forming one or more closed loops. Kinematic equivalence is assured by imposing appropriate constraints upon the motion of the general chain.

Each bar-slider pair can be represented by a plane vector expressible as a complex number. If all such vectors, directed in the same sense around the closed loop are added, their sum equated to zero yields the "equation of closure".

Displaced from its initial position, each link-vector can be expressed as the product of two complex numbers: the initial link-vector and a displacement coefficient. The sum of these products, equated to zero, is the "displacement equation".

Differentiating the displacement equation with respect to time yields the "velocity equation", and successive further differentiations lead to higher-order loop equations, each homogeneous and linear in the initial link-vectors, and with complex coefficients.

From the viewpoint of synthesis, the initial link-vectors, which define the mechanism in the starting position, are the unknowns. Each loop equation thus represents an imposed condition, with its complex coefficients containing the prescribed motion characteristics, such as displacements, velocities, etc. For example, in function generation, the input and output link rotations, analogs of the independent and dependent variables, are prescribed. If the system of equations consists of displacement equations for several discrete positions, one obtains "point approximations"; "order approximations" involve simultaneous displacement and derivative equations.

If the number of loop equations is one less than the number of unknown link-vectors, all coefficients can be chosen arbitrarily, provided the resulting system of equations is linearly independent. In case of a greater number of equations, consistency of the system is assured

if the coefficients satisfy one or more simultaneous compatibility equations, derived from the matrix theory of linear systems. Among the types of synthesis obtainable in this uniform fashion are: path, function, velocity, acceleration, pressure-angle and force synthesis.

The application of the general method to path generation occasioned the development of the "path-increment technique". Here, the loop equations contain the vector-chord of the path, and only movable links are included among the unknowns. Thus the maximum number of conditions may be imposed with the least amount of algebra. Also, newly developed analytic methods for the solution of certain nonlinear systems of compatibility equations have assured the applicability of high-speed automatic digital computer techniques.

As an illustration, four and five-point path synthesis of four-bar linkages with prescribed driving-crank rotations has been treated exhaustively. The four-point synthesis is adapted for desk-calculator techniques. The five-point theory is implemented by an automatic computer program, which determines all possible solutions (a maximum of 12 linkages), selects one on the basis of a quality index, and computes the generated path point-by-point, for every degree of crank rotation. A theory of multiple solutions is developed and utilized for finding additional solutions with little or no further computation. Both the desk-calculator procedure and the computer program can be applied without familiarity with the theory. The latter is available on pre-punched IBM cards.

The synthesis of geared five and six-link mechanisms is worked out by means of the general method for up to six points in path generation with prescribed driving-crank rotations, and up to seven points in function generation.

Suggested further work is outlined, including the optimization of path generators, and extension of the general method to space mechanisms.

Microfilm $4.10; Xerox $13.80. 320 pages.

A THEORY OF LARGE ELASTIC DEFLECTION OF PLATES

(L. C. Card No. Mic 59-2929)

Iradj G. Tadjbakhsh, Ph.D.
Rensselaer Polytechnic Institute, 1959

Supervisor: Edward A. Saibel

The problem of large elastic deflections of plates beyond the theory advanced by von Karman is investigated in this paper. Equations of motion have been derived based on the general nonlinear theory of elasticity for flexible bodies. The conditions under which these equations reduce to those of von Karman have been investigated. Method and equations have been developed by means of which any solution of von Karman's equations may be improved upon.

The case of rotational symmetry has been investigated with more generality and the problems of a plate under uniform load and combined uniform and concentrated central load have been solved.

Microfilm $2.00; Xerox $3.00. 59 pages.

STRESSES IN THE DOVETAIL OF AN AIRCRAFT GAS TURBINE BLADE RESULTING FROM SYMMETRIC AND UNSYMMETRIC LOADING

(L. C. Card No. Mic 59-2931)

Robert E. Weigle, Ph.D.
Rensselaer Polytechnic Institute, 1959

Supervisor: Michael A. Sadowsky

This investigation gives a method for obtaining an approximate solution for the stress field developed in the dovetail region of an aircraft gas turbine blade. This stress field results from the application of arbitrary loads which are distributed on the flanks of the dovetail tangs. The dovetail is treated as a two-dimensional elastic body. Only the single-tang dovetail having wedge-shaped tangs is considered here. However, this method may also be applied to the solution of a multi-tang dovetail problem, providing the tang to tang distribution of the total load is known.

The turbine blade is considered to be in a quasi-static state; i.e., the loads are considered to be static in nature and have the same value as the inertial and bending loads which result when the turbine is operating at constant angular velocity. The critical load condition occurs when the angular velocity reaches a value corresponding to the full operating speed of the turbine.

An application is made to a dovetail having a particular notch angle, for the case of symmetric (axial) loading. An approximate solution for this case is obtained. A notch stress concentration factor is found for a particular load distribution on the tangs. Application to the unsymmetric (bending) case is discussed.

The technique developed here may also be applied to problems involving an infinite, two-dimensional plate having two hyperbolic notches located symmetrically with respect to an axis lying in the plane of the plate. If this body has a load acting at a large distance from the notches, where this load is in equilibrium with a distributed load acting on the boundaries of the notches, then use of these techniques will yield an approximate solution to the stresses occurring in the plate.

The solution of any one of these problems requires a large amount of numerical work. It therefore becomes desirable to employ high speed computing equipment.

Microfilm $2.30; Xerox $8.00. 175 pages.

ENGINEERING, METALLURGY

THE FILM VAPORIZATION COMBUSTOR FOR GAS TURBINE ENGINES: THEORETICAL AND EXPERIMENTAL INVESTIGATIONS

(L. C. Card No. Mic 59-2902)

Gunter Wilhelm Maybach, Ph.D.
The Pennsylvania State University, 1959

The objectives of this study were to realize a new combustion principle for gas turbines, one that would

inherently reduce the formation of smoke and the formation of deposits inside the combustion chamber; to analyze the mixture formation and combustion mechanisms pertinent to the new combustion principle; and to determine the operational characteristics of a research prototype combustor incorporating the new principle.

The new combustion principle is based on the vaporization of the fuel from a liquid film spread along the inner wall surface of a cylindrical combustor section by means of a high-velocity air stream.

The analyzation of the mixture formation mechanisms consisted of theoretical and experimental investigations of the processes of attachment of liquid films to wall surfaces in the presence of high-velocity gas flows, spread, and stability of these films, and simultaneous heat and mass transfer from these films to the high-velocity, high-temperature air flow.

The analyzation of the combustion mechanisms consisted of experimental investigations of the flow recirculation necessary for the stabilization of the flame. Recirculation flow velocity patterns for different combustor arrangements were measured in isothermal, adiabatic flow systems.

The operational characteristics of the film vaporization research prototype combustor were determined in bench tests. These characteristics comprise the pressure loss across the combustor, the combustion efficiency, and the smoke density in the exhaust gases, each being a function of the total air-fuel ratio between the blowout (lean) limit and the flame-oscillation (rich) limit. Simulating different altitude conditions, the operational characteristics were determined for different combustor entrance conditions. Various jet fuels (from 9.8% aromatics content up to 65.7%) were successfully burned. The tests revealed smokeless and deposit-free combustion over the entire operation range of interest.

Microfilm $3.20; Xerox $11.00. 247 pages.

COPPER-RICH ALLOYS OF COPPER AND VANADIUM AND COPPER, VANADIUM AND ZINC

(L. C. Card No. Mic 59-2898)

Charles Oliver McHugh, Ph.D.
The Pennsylvania State University, 1959

Copper-vanadium alloys ranging from 0.36 to 10 per cent vanadium were prepared in graphite or alumina crucibles under an argon atmosphere. Metallographic examination of these alloys revealed that the solid solubility of vanadium in copper is less than 0.36 per cent at temperatures up to 1000°C. Extreme difficulty was encountered in obtaining complete solution of vanadium in liquid copper when the vanadium content exceeded 2 per cent. This tendency toward inhomogeneity and segregation prevented the quantitative evaluation of the extent of solid solubility of vanadium in copper.

Cooling curves of all copper-vanadium alloys exhibited a thermal arrest at 1085°C. No indication of a change in slope corresponding to the liquidus was observed in these cooling curves. The nearness of the temperature of the thermal arrest to the melting point of copper is indicative of restricted solid solubility of vanadium in copper.

X-ray diffraction analysis of several alloys revealed that the alloys consisted of two phases, a vanadium-rich phase and a copper-rich matrix. No intermetallic compound is formed between copper and vanadium. A slight shift of the lines of the copper-rich matrix from those of pure copper was observed; at least a part of this shift might be attributed to a small solubility of vanadium in copper.

Copper-vanadium-zinc alloys ranging from 60 to 95 per cent copper and 0.10 to 3 per cent vanadium were prepared in graphite crucibles under an argon atmosphere. The vanadium was added to the alloys both as the pure component and as a zinc-vanadium master alloy. Although zinc and vanadium form an intermetallic compound, the microstructures of all ternary alloys consisted of two phases, a matrix of alpha brass and a vanadium-rich phase which resembled that observed in the binary copper-vanadium alloys. The vanadium-rich phase was not identified in the x-ray diffraction analysis of these ternary alloys.

A tendency toward segregation of the vanadium-rich phase was observed in all ternary alloys. Rapid cooling achieved by pouring the molten alloys into graphite molds or into water did not result in alloys which were homogeneous enough for an evaluation of mechanical properties.

The solid solubility of vanadium in brass is less than 0.10 per cent at temperatures up to 950°C. The inhomogeneous nature of these alloys prevented a more exact determination of the extent of ternary solid-solution formation in the copper-vanadium-zinc system.

All alloys prepared in this investigation were successfully worked by cold-swaging operations with intermediate annealing after 50 to 60 per cent reduction of area.

Microfilm $2.00; Xerox $5.00. 97 pages.

SURFACE PHENOMENA IN IRON AND IRON-BORON ALLOYS OF ULTRA-HIGH PURITY

(L. C. Card No. Mic 59-2908)

Bennie Frank Oliver, Ph.D.
The Pennsylvania State University, 1959

A study has been made of surface phenomena in high-purity iron and high-purity iron-boron alloys. The iron was purified by the process of crucibleless (vertical) zone melting in an atmosphere consisting first of wet hydrogen and then of pure hydrogen. The estimated minimum purity of the material so produced is 99.995 percent of iron by weight.

The iron-boron alloys were produced by zone-leveling elemental high-purity boron into bars of the purified iron, also held vertically and without a crucible. The liquid zones containing boron were mechanically unstable, the surface tension of the boron-containing liquid being too low to support the liquid. The leveling could be successfully carried out, however, when a direct current of 120 amperes was passed through the bar during leveling. The pinch effect of this current produced a sufficient internal pressure within the bar to stabilize the zone.

Alloys containing boron at levels from 6 to 60 parts per million by weight were made in this manner. The

analyses of these alloys and of the pure iron involved many complexities, which are described.

The effective redistribution coefficient of boron in iron was determined to be approximately 0.1 for the experimental conditions used. The equilibrium value is 0.05.

Several possible experimental methods were evaluated for determining the surface and grain-boundary tensions of pure iron and of the iron-boron alloys. Only two of these methods seemed promising. One involved the measurements of the dihedral angles, of grooves solution etched in the surface of iron while heated in contact with liquid silver, at points on the surface of the iron where grain boundaries emerge.

The results of this study were negative, since preferential solution etching did not occur. The experiment did, however, establish the fact that the dihedral angle at the interface between solid-iron and liquid silver is effectively 180^0. From this result one can conclude that the tension of the interface between solid iron and liquid silver is very much greater than the grain-boundary tension of iron. This appears to be the only alloy system so far found where this is so.

The other promising method, developed in the course of this study, is to measure the rate of filling of V-shaped grooves previously made in the surface of the iron or of the iron-boron alloy, during prolonged heating in an essentially inert atmosphere. This method constitutes a kinetic approach to the same problem. Measurements were made on specimens of pure iron and on one of the iron-boron alloys. The experimental phenomena associated with the rate study were found to be complex. Grooves exhibited filling only if an associated grain boundary ended in the root of the groove. Grooves that had no accompanying grain boundary were observed to deepen with time instead of filling, and exhibited extensive crystal-face development.

A simplified potential model was set up to represent the experiment, and from it the surface and grain-boundary tensions could be calculated to within a factor of 10 of the expected values. In the model, the grain boundary was considered a sink for vacancies generated at the curved groove surface.

The results of the calculations indicated that the surface and grain-boundary tensions of the iron-boron alloy were greater than those of the pure iron. This result is contrary to the inference that can be made from current hypotheses concerning the hardenability of boron-containing steels.

The model predicts that the rate of filling depends primarily on four factors: the surface tension, the dihedral angle of the thermally etched groove at the intersection of the grain boundary with the surface, the depth of thermal etching at the grain boundary, and the curvature of the groove surface. The results found may have important applications in the theory of sintering.

Microfilm $2.00; Xerox $6.20. 130 pages.

FINE ARTS

THE AMERICAN LITHOGRAPH FROM ITS INCEPTION TO 1865 WITH BIOGRAPHICAL CONSIDERATIONS OF TWENTY LITHOGRAPHERS AND A CHECK LIST OF THEIR WORKS

(L C. Card No. Mic 59-2547)

John Thomas Carey, Ph.D.
The Ohio State University, 1954

Probably no other graphic medium became so inextricably bound up with the life of its people and times as did the nineteenth-century American lithograph. No subject was too lofty and none too low to be captured by the lithographic crayon. It became the fine art, the genre art, and the commercial art of its day, and no one was concerned as to its versatility in this matter.

From its introduction into this country from Europe in the first quarter of the nineteenth century to its eclipse in the last quarter of the century, it reigned graphically supreme; at its demise it went out in a blaze of raucous color to be followed by another art form--mechanical lithography in its many variations. But during its time it was produced in almost unbelievable quantities, e.g., the Library of Congress Print Department has over 10,000 pieces of lithographic matter.

What then were the attributes of this medium that made it outstrip its predecessors? The foremost was its rapid reproduction of such diverse material as portraits, maps, periodical illustrations, sheet music covers, real estate plans, cartoons, handbills and advertisements. A stone could be readied for printing in an hour by an experienced artist or craftsman. Up to 5,000 impressions could be secured if the technician knew his process. Secondly, the results of lithography are highly autographic--what is put down on stone is transferred to the paper in exact duplication, only in reverse. What we today think of and classify as "fine art" prints once served a multitude of more ignoble purposes. In a more commercial vein these prints were, for example, the trade cards of a hatter's shop, the portraits of stud horses incorporated into exotic backgrounds, or of stage favorites rendered on sheet music covers. Large portions of the lithographs of this period fall into the classification of news and were a popular contribution to the people they served.

Alois Senefelder, the inventor of lithography, developed the theory and all the basic techniques that were used in lithographic printing before the advent of chromolithography. His discovery was made in Bavaria in 1796.[1] The history of lithography, both here and in Europe, constituted an unsuccessful quest to produce a lithographic printing process that could be followed as an exact scientific procedure.

In reviewing the historical writings on the development of the technical phases of lithography in this country one

finds an attempt from the beginning to free the industry from dependency on Europe. Experiments were made with Vermont marble, Indiana and Ohio limestone to try to discover a satisfactory substitute for the imported and expensive Bavarian limestone.[2]

When Bass Otis's lithographic print of the "Bath House" appeared in the Analectic Magazine of 1819, it was as an example of the process accompanying an article on lithography and including a description of the press.[3] This was the report to the American public that such a medium did exist. Barnet and Doolittle in 1822 formed the first lithographic house. They had learned the technique in France. Thus the lithographic plants and publishers of France[4] and England[5] supplied America with the basic knowledge of the lithographic technique. It is possible that the first American artists knew the technical aspect of lithographic printing, but soon the printing process was known only to the craftsman and pressman.

Of all the publications in the first third of the century to explain and foster the art of lithography, none was to assist its development more than the Journal of the Franklin Institute.[6] From 1827 to 1831 it published such technical articles on the art of lithography as, "On the Precautions to be Observed in Writing or Drawing Upon Stone"[7] and offered prizes for lithographic works printed with native materials.

Before the achievements of the best production in black and white or tonal lithography had been perfected, the search for colored lithography started.[8] The simplest method of coloring was the laying of a color or tone over the entire background of the print; this process was called tinting. Senefelder's lithotinting process was further developed by Hullmandel of England and came to this country in 1843.[9] This process of securing colored prints from a single stone was unsatisfactory and true color printing did not appear until around 1848. In 1856 P. S. Duval of Philadelphia was running steam-operated presses but still employing colorists who applied color by hand; by 1865 this gave way to complete color printing.

When in 1804 Benjamin West made his lithographic drawing "He is Risen, He is not Here" for the Specimen Book of Polyauthography[10] in England, he very probably was the first American artist to make a lithograph. In keeping with the rest of the drawings in this sample book there is nothing outstanding about West's print. Lithography at this time was known as Polyautography and later is sometimes spelled lythography.

It is uncertain who was responsible for the importation of lithography into the New World although the importation may well have been via one of West's pupils. In an early artist's handbook of 1814 there is found under the heading of Etching a subdivision of Stone Etching, followed by a short description of etching on stone. The article states that it describes a process which is used by a group of gentlemen in London, including Mr. West.[11] The description shows the process to be true lithography. As early as 1808 a Dr. Mitchell of New York received a lithographic stone and inks from Paris and made some experiments.[12]

The artist Bass Otis has generally been accorded the honor of producing the first American lithograph which can be dated. Technically his first works are a combination of etching on stone and lithography.[13]

J. Milbert signed one of the plates, "Coal Mines of Trueil near Etienne," in The American Journal of Science and Art of 1822; that makes it one of the first true lithographs printed in this country. It was printed by Barnet & Doolittle of New York. The Grammar of Botany lithographed by the same firm in that year is thought to be the first American book to use lithographic illustrations. Thus Milbert, the French artist-engineer, may share honors with his fellow countryman Charles LeSueur as the producer of the first true lithography in America. LeSueur lithographed a plate of three fishes for the Philadelphia Journal of the Academy of Science.[13]

Using Vermont marble, Henry Stone started his lithographic plant in Washington D. C. in 1823 and lithographed the first music sheet cover, for "The Soldiers Tired," in that year. The famous Maverick family of Newark, N. J. and New York City added lithography to engraving in their firm around 1824–25; the daughters did most of the work that is now extant.[14] Anthony Imbert, the marine painter of New York, started his press in 1825.[15] He printed one of the earliest cartoons in the lithographic medium; this cartoon was of "Jackson and John Quincy Adams" for the political campaign of 1828. The Pendleton Brothers of Boston embarked on a lithographic career in 1825.[16] Their firms are especially important to the history of the American graphic arts, for they were instrumental in the spread of lithography into areas that were to become the major lithographic centers of the east, and they employed artists like Rembrandt Peale, B. F. Nutting, D. C. Johnson, and H. Walton. In 1828 Kennedy & Lucas started a Philadelphia lithographic house which was taken over by the artists C. G. Childs and Henry Inman. The house is best known for the early sporting and nature prints which it lithographed for Thomas Doughty's Cabinet of Natural History and Rural Sports (1830-33) and for employing the artist George Lehman. This firm was to develop into one of the major printing houses of the east when P. S. Duval took it over in 1834.[17] The deaf-mute Albert Newsam was the outstanding copyist for the Duval concern. From 1831 on, the number of lithographic houses increased rapidly. By 1840 William Sharp had arrived from England to aid in the development of chromolithography and to establish his plant in Boston.[18]

The 1840's saw the medium of lithography achieve maturity. The heavy influx of foreign artists undoubtedly increased in number the skilled craftsmen who had been so difficult to find in the days of the Pendletons.

By 1850 lithography was firmly entrenched as a portrait medium and was venturing into all of its commercial phases, into magazine illustration, books, annals, album cards, and sheet music covers. At this date the printing houses started to do specialized work and became known for a special type of print.

Around 1865, with the aid of the steam operated press, the gaudy chromolithograph was superseding black and white;[19] commercialism, news value, and illustration became more important than art quality. From this point on the lithograph begins to be supplanted by the wood cut and the steel engraving, and finally, by the eighties, it is reduced to a third-rate position in the field of illustration. The aim of replica is an anti-art as the total emphasis on content, to which it is closely allied. With the growth of this dual emphasis starting in the sixties, lithography went into semieclipse as an art form in the United States.

Within the lithographic prints that may be considered to possess art quality is a large classification known as the view print. It covers an extremely wide range of subject matter and includes landscape, genre, and historical

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

views. Although the early patterns of American views were to be influenced by European models, soon American tastes and preferences were to predominate.

An examination of the view print shows that one of the largest divisions is the city view. This category encompasses almost every facet of city life: its parks, store fronts with horse drawn vehicles, parades, horse races in the street, and portions of quiet residential districts. One of the first men to try to capture the diversity of his city was W. L. Breton who made a series of nineteen known views of Philadelphia around 1830. The "Philadelphia Exchange" (c. 1835) by George Lehman is one of many versions of this building. Lithographs of important buildings in their setting were very popular.

Two more divisions of city views are to be found in the matched pair, summer and winter views of the same subject matter, and in the bird's-eye-view presentation. Both of these elements are found in the prints of John Bachmann's "Central Park Summer" and "Central Park Winter."

The marine print is the second largest division of view prints and is characterized by the anonymity of the artist. Some of the outstanding work in this area is by Fritz Hugh Lane, as can be seen in his "View of Gloucester, Massachusetts" (c. 1845). James Queen did some excellent marine views which also might be classified as genre. Typical of these is his "Shad Fishing" (c. 1857).

The third largest category is that of the historical print. It documented the historical past of America, American wars and places where Americans were engaged in activity. The "Conquest of Japan by Admiral Perry" by numerous artists, "The Railroad and Survey Expedition Prints" from sketches by John Mix Stanley and others, and the "Naval Portfolio" by Lt. H. Walker (1848) covering the Mexican War are material of this nature.[20]

Concurrent with the favorable sociological conditions of more widespread leisure, security and travel, a landscape art movement was to emerge in this country around 1825. It developed rapidly and was to foster an extensive production of lithographic views. The entry of Thomas Doughty of the Hudson River School onto the painting and lithographic scene definitely promoted the production of landscape lithography as seen in his "Lake George Scenery" (c. 1831).[21] Like the painters of the period, the lithographers paid meticulous attention to the rendering of the minutiae of nature. The lithographic crayon was especially adaptable to the capturing of atmospheric effects, and this capacity was probably its greatest contribution to the graphic arts.

The lithographic portrait contributed to the nineteenth century the means of faithful, relatively cheap, multiple reproductions. It also served the individualism and humanism of its day in America. It is true that many of the lithographic portraits were copies of paintings and were put on stone not by the men who painted them but by professional copyists. Exceptions to this are found in B. F. Nutting, Charles Fenderich, and A. Hoffy. Rembrandt Peale[22] and Albert Newsam copied the work of other artists and did originals of their own. In a good many instances the copyist was so proficient, as in the case of Albert Newsam, that a work of lesser quality might have been produced had the artist himself tried to do the lithographic drawing. In some instances the portrait was probably improved upon from the standpoint of design. The lithographic portrait generally included a fairly complete background while the painted portrait of this time generally presented the figure without a background. Charles Fenderich is an example of the portrait artist who understood the full potentials of the lithographic crayon. His portraits show that he could draw from it an amazing range of tone; see, for example, his portrait of "William Costin" (c. 1840) and of "President Tyler" (1844).

If one considers the nineteenth-century American lithograph as a whole, the years from 1830 to 1845 are the years of greatest artistic achievement. It is probably true that the technical process of printing is better at a later date, but the production ten years after its start in this country is of a high calibre. One of the reasons for the superiority of the work of this time is that it is still an artist-identified art in comparison with the later phase when it became a craftsman's art. In this period of the 'thirties and forties we find the names of recognized artists like M. E. D. Brown, Rembrandt Peale, J. C. Wild, and Thomas Doughty. By the 1850's illustrators like Edwin Whitefield and August Kollner were to use the medium for its reproductive qualities alone.

The lithographs of the first half of the nineteenth century illustrate the joys of the people, their diverse accomplishments and their pride in Americans and things American. These elements are to be found in such prints as "American Trout," "The Trotting Race Between Lady Suffolk and Lady Moscow," "The Building of the Washington Monument," "In Wissahickon Park," "The Portrait of Benjamin Franklin," and the "Proposed Elevated Railroad for New York City."

Its anonymous artists campaigned for justice, as illustrated in the anti-slavery prints before the Civil War; its portraitists offer to our age the likenesses of tycoons and unknown men who lived and whose only record that they lived is illustrated in their lithographed portraits.

My nominations for the best lithographs of the period would include such material as "The Portrait of Mother and Child," by Stuart Newton; "The Hudson River Looking North from Fort Putman," by A. J. Davis; the Marine Views of Fritz Hugh Lane; "The Naval Portfolio," by Lt. H. Walker; "The Portrait of Washington," by Rembrandt Peale; and the "Portrait Gallery," by Charles Fenderich. In my opinion these lithographic works rank with the best American art of the period.

The dissertation also includes biographical data and an investigation of the lithographic endeavors of the following twenty representative artist-lithographers of the period, including a check list of their work: M. E. D. Brown, George Catlin, J. Foxcroft Cole, A. J. Davis, Thomas Doughty, Charles Fenderich, Gustavus Gruenwald, Winslow Homer, Henry Inman, August Koellner, Fritz Hugh Lane, George Lehman, Albert Newsam, B. F. Nutting, Bass Otis, Rembrandt Peale, William Sharp, H. Walton, Edwin Whitefield, and J. C. Wild. Microfilm $5.95; Xerox $20.80. 466 pages.

1. Senefelder, Alois. The Invention of Lithography, Trans. by J. W. Muller. New York: Fuchs & Lang, 1911.

2. History of American Manufacturers, 1800-1860. Philadelphia: Ed Young & Co., 1860, I, 252.

3. "The New Art of Lithography," Analectic Magazine, II (1819), p. 163.

4. Peters, Harry T. America on Stone. Garden City, N. Y.: Doubleday Doran & Co., 1931, pp. 88-90.

5. Burke, W. J. "Rudolph Ackerman Promoter of the Arts and Sciences," The New York Public Library Bulletin (1935), p. 35.

6. Published by the Franklin Institute, Philadelphia, 1827-1831.

7. Journal of the Franklin Institute, IV (1827), pp. 343-349.

8. Cf. The Athenaeum, II (1829), p. 447.

9. Cf. "The New Art of Lithography," Miss Leslie's Magazine (April, 1843), pp. 113-114.

10. The only copy that I have seen is at the Metropolitan Museum of Art, New York City.

11. Catbush, Jas. The American Artist's Manual or Dictionary of Practical Knowledge in the Application of Philosophy to the Arts and Manufacturers. Philadelphia, 1814.

12. The National Intelligencer and Washington Advertiser (Jan. 8, 1808).

13. George Eckhardt discounts Otis's works as lithographs and asserts that the first true lithograph was made by Charles LeSueur in 1822. See his article "Early Lithography in Philadelphia," Antiques, XXVIII (1935), pp. 249-252.

14. Stephan, Stephen Dewitt. The Mavericks. New Brunswick, N. J.: Rutgers University Press, 1950.

15. Peters, America on Stone, p. 228.

16. "Notes and Papers on Lithography from the Collection of the Late Charles H. Taylor," Deposited at the American Antiquarian Society.

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21. Sweet, Frederick A. The Hudson River School. New York: The Whitney Museum of American Art, 1945, pp. 35-41.

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EXPERIMENTS IN THE DECORATIVE USE OF VITREOUS ENGOBES

(L. C. Card No. Mic 59-2749)

Robert Ward Ramsey, Ph.D.
The Ohio State University, 1959

The vitreous engobe has been used by both industrial manufacturers of pottery and studio potters as a material for obtaining decorative effects, but because of its similarity to glazes and non-vitreous engobes, the vitreous engobe has not always received recognition as a distinct material having definite physical characteristics of its own. Because of the studio potter's need for a versatile decorative material which can be applied to vitrifiable stoneware clays, the vitreous engobe was selected for artistic experimentation.

The major portion of the dissertation consisted of an exhibition of ceramic wares, created by the author and illustrating the results of the exploration. This exploration involved the development of suitable forms on the potter's wheel and experimentation with decorative techniques which most clearly revealed the potential range of color and textural effects obtainable with vitreous engobes. In this endeavor, careful inspection of the physical characteristics of the materials involved in the composition of the vitreous engobe was an important and necessary part.

Because of its suitable behavior one of the series of tested engobes was selected to be used for further experiments to determine the color range possible at the point of vitrification in both oxidation and reduction firings. The colors obtained in reduction, being muted and subtle, seemed more appropriate for use on coarse stoneware bodies, consequently oxidizing fires were discontinued in subsequent trials.

A series of tests involving a number of known glaze compositions was conducted to ascertain which glazes would permit the vitreous engobe to burn through and produce a colored decorative surface. These tests demonstrated that color and surface appearance were appreciably altered by the firing conditions. After numerous trials, a satisfactory firing procedure was evolved which produced consistent and predictable results.

Several decorative historical slip techniques were then chosen for experimentation. Those selected were pouring in contour patterns, dipping, surface impressions, free-brush painting, slip trailing, sgraffito and mishima. The spontaneous techniques were preferred to those which required a more meticulous approach.

The acquired knowledge of a particular vitreous engobe, along with the selected techniques of applying it as a decorative material, made it possible to evolve pottery forms which enhanced and revealed the most salient features of the material. Most of the pottery forms were simple in configuration, permitting the application of the engobe by pouring. This technique proved to be the most satisfactory method of obtaining a smooth surface as a background for decoration. Experiments in the addition of foreign materials, such as vermiculite and sawdust, resulted in textural effects, increasing the irregularities in the surface of the pot.

Experiments in decorative techniques indicated the vitreous engobe to be a versatile material. It could be applied to either green ware or bisque; used alone, without a covering glaze, it produced a dry rough-textured surface having a soft neutral color that complemented the warm tones of the stoneware body. The vitreous engobe was equally satisfying when used under a glaze to provide subtle nuances of color and as a vehicle for carrying granular oxides of metals. Because of its close relationship to glazes and clays, the vitreous engobe acted as an excellent intermediary layer between the clay body and the glaze, satisfying both technical and aesthetic demands.

Microfilm $2.00; Xerox $6.80. 145 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

SAINT SEBASTIAN IN ART

(L. C. Card No. Mic 59-746)

Irving L. Zupnick, Ph.D.
Columbia University, 1958

The latest information on paintings of Saint Sebastian, worshipped as protection against pestilence, has been reviewed for changes in iconography, composition, and ideological emphasis. These changes, from the fifth to the twentieth century, and comparisons between the paintings of Central and Northern Italy, France, Germany, Flanders, and Spain, have been correlated with the cultural, historical, and sociological background.

The earliest extant images seem to indicate little interest in the legend of the Saint, who is shown as a generalized figure, requiring an inscription for identification. The clothed, bearded figure was in vogue after 680, when the first written record of an appeal for his intercession appeared. The first extant cycles of pictures based on his legend date from late in the eleventh century, appearing in churches in Rome. The development of the Central Italian composition is based upon these early cycles, and upon the symmetrical compositions which portray the Crucifixion. As early as the twelfth century a bilateral type of composition for the martyrdom developed in Northern Europe, which gradually infiltrated into Northern Italy and Spain. German and French artists portrayed the Saint with strong emphasis on the pathos of the ordeal, representing him generally as a beardless young man, in contrast to the more mature and calmer Central Italian type. Late in the fifteenth century an interest in classical art is shown in the architectural settings and Apollo-like physique of the Saint in Central Italian painting. There is also a didactic emphasis in paintings of this school, revealed in the ruins of Pagan Antiquity and the dart-throwing angels who terrify the archers. The classical emphasis, without the didacticism, infiltrated into Northern Italy, and by the sixteenth century, into Northern Europe and Spain. In the sixteenth century, after a brief period of decorative mannerism, the subject of Saint Sebastian is treated with stronger pathos and emotionalism.

The sensational spectacles of Renaissance painting gave way, under the impetus of the Council of Trent, to a more intimate and idealistic type of imagery. The martyrdom was shown usually without the archers and as a close-up. The Saint was usually handsome, and realistically fainted from his wounds. The subject of Saint Irene, who nursed Saint Sebastian to health after he was shot by the archers, became an important one, indicative of Christian charity and tenderness, two important themes in this sentimental age.

The subject persisted into modern times, long after its cultural significance had been lost. In the nineteenth century Delacroix chose it as a romantic subject, while Corot made it the theme of a landscape. In the twentieth century it was given a surrealistic interpretation by Alfred Courmes. Microfilm $3.80; Xerox $13.00. 296 pages.

CHANGES IN COCOA TANNINS DURING PROCESSING

(L. C. Card No. Mic 59-2670)

Anthony William Ranalli, Ph.D.
Syracuse University, 1959

A study was made of the tannin constituents of cocoa and their chemical changes during chocolate processing. Specifically, this investigation was concerned with the changes in some tannin components of cocoa due to roasting, alkalization and conching.

The methods employed included paper chromatography, chemical fractionation, and ultra-violet and infra-red spectrophotometry. Improvements in the chromatographic analysis of tannins are described.

Analyses of fermented (reference sample), roasted, alkalized and conched samples of cocoa by paper chromatography indicated the constituents were identical in all samples. Paper chromatograms also indicated that no chemical changes occur in the constituents during processing. However, spectrophotometric analysis of isolated compounds, indicated that changes did occur in the spatial configurations of the molecules. These changes could involve inversion of the configurations around the asymmetric carbons of the pyran ring.

One of the isolated compounds was identified as l-epicatechin. The concentration of this compound diminishes on roasting, and changes in the spatial configuration of the molecule are effected during the alkalization or conching processes.

Two other isolated compounds, which were not identified, were found to undergo configurational changes during roasting. No further change occurs during alkalization. However, the changes which occur during roasting were found to be reversed by the conching process.

It was also concluded that, (1) the three isolated compounds are structurally similar; (2) the chemical constituents of the samples studied were not identical; (3) the fermented sample contained two compounds which are either protein or condensed tannins, possibly peptido-polyphenols, six amino compounds, and three ketohexoses; (4) there were no anthocyanins present in the samples analyzed. Microfilm $2.00; Xerox $5.00. 97 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

INVESTIGATIONS ON THE PRESERVATION OF OYSTERS

(L. C. Card No. Mic 59-1764)

Mark G. Schwartz, Ph.D.
The Florida State University, 1959

Bacterial decomposition in oysters may be inhibited by refrigeration, freezing, ionizing radiations and the use of antibiotics. When bacteria are inhibited or destroyed, the storage life of oysters is limited by non-bacterial spoilage mechanisms, particularly oxidative and enzymatic changes. This investigation was concerned with (1) observations of spoilage patterns in oysters preserved by refrigeration, freezing and irradiation and (2) the development of effective means of measuring and retarding rancidity in oysters.

A simple modification of the 2-thiobarbituric acid (TBA) test for oxidative rancidity has been adapted to oysters. The test may be performed directly on the oyster tissue without previous extraction of fat. As measured by this test, cooked refrigerated oysters exhibited a definite induction period during which the TBA values did not increase over those for freshly cooked samples. At the end of the induction period there was a very rapid increase in the TBA values which corresponded closely with the development of "rancid fish" odors. Cooked frozen oysters behaved in a similar manner with the exception that there was a much slower rise in TBA value and no definite induction period. Uncooked refrigerated or frozen oysters (packed in liquor) did not show a consistent increase in TBA values nor did they develop rancid odors. The development of rancidity occurred when the oysters were packed without liquor (cooked refrigerated and frozen oysters and individually frozen raw oysters) and exposed to air.

The addition of the more widely used phenolic antioxidants in animal fats inhibited the development of "rancid fish" odors and high TBA values in cooked refrigerated and cooked frozen oysters. Ascorbic acid inhibited oxidative changes occurring in cooked oysters and to some extent when employed as a dip for individually frozen oysters. When one considers the high copper content of oysters the antioxidant properties exhibited by ascorbic acid are quite surprising. Manometric experiments, measuring the oxygen uptake of copper and ascorbic acid, have shown that cooked oyster is a more effective inhibitor than raw tissue of the copper catalyzed oxidation of ascorbic acid. It has been suggested that sulfhydryl groups, exposed upon cooking, chelate the copper and allow ascorbic acid to function as an antioxidant.

Several batches of both raw and cooked oysters received doses of gamma rays ranging from low pasteurization ($2x10^5$ rads) to sterilization ($3x10^6$ rads). Spoilage changes were observed over a number of months at both room and refrigerator temperature. Oxidative changes did not occur in either raw or cooked oysters presumably because the oysters were covered with liquid and not exposed to air.

The irradiation of raw oysters in no instance was found to yield a satisfactory stored product. Spoilage was characterized by a grassy sour odor, an intense greening of the stomach or "eye" area and flabby texture. Reactions responsible for these changes were not identified. In addition gas formation (swollen cans), attributed to bacteria, was observed especially at lower doses.

Spoilage of unirradiated and irradiated cooked oysters exposed to doses under 10^6 rads was characterized by swollen cans and putrefactive odors. Bacterial examinations indicated the presence of anaerobes. As judged by a small panel, cooked oysters irradiated at $5x10^5$ rads and stored at 41°F. (5°C.) were considered acceptable after 180 days. Cooked oysters irradiated at $1.5x10^6$ rads and stored at 70°F. (21°C.) were considered acceptable after 240 days. The irradiated (sweet-brothy) odor was observed to diminish over an extended storage period in samples stored at room temperature.

Microfilm $2.00; Xerox $4.00. 73 pages.

GEOGRAPHY

A LINE SAMPLING STUDY OF FOREST LAND OWNERSHIP AND MANAGEMENT IN THE WEST

(L. C. Card No. Mic 59-1202)

Vaughn Porter Manley, D.S.S.
Syracuse University, 1958

This study illustrates two planes on which it is proposed that the use of statistical line sampling may be broadened with some accuracy in forestry studies. The first is the areal base of line sampling studies and the second is the substantive scope of such studies.

Line sampling is a methodology used for the past ten years in the study of forest land ownership in California. It essentially involves drawing parallel lines at regular intervals across a base map, recording intersections of those lines with property boundaries taken from county plat maps, and measuring the total length of line crossing properties in each predesignated class of ownership. The average length of line crossing properties of a given size class determines the figure by which the mean acreage and number of holdings intersected in the class are multiplied to estimate total acreage for that class.

Curves of such figures, called multipliers, were developed from data obtained in coastal northern Mendocino County, California in 1948 by A. A. Hasel and Adon Poli. The curves were intended for use in the West, where distribution of properties by township and range has produced a general rectangularity of properties which makes possible relatively accurate estimates based on line sampling.

The present study of El Dorado County, California, in the Northern Sierra Nevada, describes, first, an adaptation of the Hasel-Poli curves for use in accurately broadening the areal base of line sampling studies from the original

Coast Range setting. The study illustrates the use of a preliminary sample of a number of properties in each size class to test the appropriateness of the Hasel-Poli multipliers to physical- and cultural-geographic characteristics in the Northern Sierra Nevada. It was hypothesized that some of these characteristics could differ so from the original Coast Range case that a new average shape of properties would be found for some size classes, requiring new multipliers for those classes. The fact that new multipliers do result in nearly every instance is taken to indicate that investigators should test for differences from the Mendocino figures wherever interest in line sampling develops in those parts of the West where county plat maps are available.

The study describes a second adaptation of line sampling procedure aimed at studying timber management, which Hasel and Poli did not attempt. The illustration, based chiefly on reports from local informants, suggests that timber management data be tabulated as specific practices rather than as a brief listing of value judgments. This suggestion applies to studies of quite large timbered areas under private management, for the El Dorado sample is small enough in certain categories that a small chance fluctuation in sample data for an ownership class produces a large relative change in the estimate for that class.

A supplementary suggestion for like studies of timber management is the construction of a map describing the sample by symbolizing type of ownership, size of holding, and one or more dimensions of timber management. Such maps are shown to add to the usefulness of the statistical tables at the county level, particularly in comparing the relative effect of a given forestry practice in different locations. The size of the study is shown not to affect the usefulness of such maps.

It is concluded that similar statistical-cartographic studies may also be valuable in locating ownership classes which warrant intensive field observation, either isolated, or as part of a study of blocks of ownership representative of the various classes of owners found in the project area.

Microfilm $2.25; Xerox $8.00. 172 pages.

THE KIND AND QUANTITY OF MANUFACTURING INDUSTRY IN COMMUNITIES UNDER 10,000 POPULATION IN WESTERN NEW YORK

(L. C. Card No. Mic 59-2671)

Robert Thomas Redden, D.S.S.
Syracuse University, 1959

Numerous factories are scattered through the small communities of Western New York State. The purpose of this study is to discover the kind and quantity of manufacturing in these communities and their attendant locational advantages and disadvantages.

New York State west of the eastern border of Allegany county was selected as the area of the study. Population centers of more than 10,000 persons were excluded in the interest of focusing attention upon the smaller community and the rural area. The region of the study covered 7096 square miles or 14.8% of the total area of New York State. The population of Western New York totals 1,486,542 or 10.3% of the entire state. The rural areas of the region account for 592,139 persons or approximately 1/3 of the above figure.

A total of 395 manufacturing industries were found in the rural areas of the region. These were located by field study methods and interviews were conducted with owners, proprietors, or the management staffs of the installations.

The industrial units of the region are predominantly small with labor forces of fifty or less employees; 246 firms fall in this category. Larger units are also present with twenty factories having labor forces of 500-999 workers.

Reliance upon local raw materials is a significant characteristic of the industry. At least half of the installations meet this criterion. Conversely local markets are of much less significance for practically all of the industries are oriented to the larger marketing area of the northeastern United States. In several instances national and international markets are claimed by management.

Independence from the urban markets of Western New York is conspicuous. Local ownership and financial independence are also noteworthy. Family control and individual management are a common feature. The firms are stable and long-lived with a large proportion having been at their present location for twenty-five or more years.

Conscious weighing of geographic factors by owners before locating plants has been conspicuously absent. Probably no more than 10% of the factories were located upon the consideration of geographic factors. It can be assumed that the region is hospitable to small industrial units which add considerable value to the product in manufacture. Processing costs including labor, overhead, etc. are generally favorable and there are few strong disadvantages as far as assembly and distribution costs are concerned.

Manufacturing is, in some cases, significant in the national industrial scene. At least half of the manufacturers rate themselves among the top three producers in their particular specialties. Specialization is notable and is a characteristic of the rural industry.

Regional concentration of the industries occurs to a limited degree in wood industries, dairy products plants, and fruit and vegetable processing plants. This generally is in response to local raw material sources. Other production facilities are dispersed through the region in random fashion.

Many of the industries have weaknesses which are recognized by owners and managers. There is great reliance upon a single product which makes their future uncertain. Diversification is economically difficult for the units. The research costs for the development of new products are often beyond their reach. In spite of this the factories have sustained themselves for many years and in some instances have developed new products as former markets atrophied or disappeared.

Common reliance upon a single person for leadership is another major weakness of the industries. The owner-manager-production specialist sort of person is very common in the small industrial unit. His death, illness or retirement may leave the firm without the leadership which is vital to its continuance.

Small town manufacturing industry is important to both the individual community and the region as a whole. At least 75,000 persons in Western New York rely directly upon these industries for a living. Numerous service industries, community functions and public institutions draw financial support from the industries. They have a major role in providing prosperity and a higher standard of living in the region. Wage and salary payments are conservatively estimated at $75,000,000.

Microfilm $2.00; Xerox $7.00. 147 pages.

THE CENOZOIC GEOLOGY OF THE CHETOH COUNTRY, ARIZONA AND NEW MEXICO

(L. C. Card No. Mic 59-2606)

Paul William Howell, Ph.D.
University of Arizona, 1959

Supervisor: John F. Lance

The Chetoh country comprises a section of the Colorado Plateau north of the Little Colorado River, extending from Zuni Uplift west to the Painted Desert. The decipherable Cenozoic geology of the country is confined largely to the latter part of that period. The record indicates that this region has had a generally arid climate throughout late Cenozoic time, but that relatively humid conditions existed in both late Miocene and late Pleistocene times.

The Tertiary stratigraphic record begins with the Zuni erosion surface, the origin of which may extend back to Oligocene time. This is followed in ascending order by the Zuni pebble zone, the late Miocene-early Pliocene Chetoh formation, the early Pliocene Hopi Buttes erosion surface, and the middle to late Pliocene Bidahochi formation. The Quaternary epoch begins with the Navajo erosion surface, followed in ascending order by the early Pleistocene high mesa fill, the mid Pleistocene Gamerco formation, the late Pleistocene Jeddito fill, and the Recent Naha fill. These formations are composed largely of sands and silts, except for the lower Bidahochi which consists largely of red-and-green-banded clay. Lenses of white, rhyolitic ash are common throughout the Tertiary strata, and in the Chetoh formation much of this ash has been converted to montmorillonite. A basic volcanic sequence forms the middle member of the Bidahochi formation. In general the Quaternary sediments are coarser, and gravel becomes an important component.

The mineralogy of the sediments suggests three likely sources, the two most important being the early Tertiary sediments of northwestern New Mexico, and the early to middle Tertiary volcanic rocks adjacent to the south of Zuni Uplift. The third strongly contributing area was the mountains which, until late Tertiary time, overlooked the Plateau from south of Mogollon Rim. In Quaternary time volcanic material from the east and southeast of Zuni Uplift becomes very significant.

The chemical environments of the Tertiary show a change from weakly carbonate, low alkali conditions of Chetoh time to the strongly carbonate, high alkali conditions of Bidahochi time. This is believed to account for the restriction of montmorillonite formation to Chetoh time. The chimical environments corroborate previous estimates of climatic conditions based on stratigraphy and sedimentation. The principal clay of the Bidahochi is brammalite.

The geomorphology of the region indicates that the present Colorado River drainage was established in Pliocene time, and main tributaries were largely consequent along northwest-trending tectonic lineaments. The Chetoh country drained southeastward into the Rio Grande system until reversed by uplift and capture in late Pliocene time. Uplift of the northwestern part of the Plateau in early Pleistocene time caused the high mesa fill alluviation, the position of which indicates that much of the Grand Canyon was cut before the Pleistocene epoch.

Microfilm $4.25; Xerox $14.20. 329 pages.

OZONOLYSIS OF THE ORGANIC MATTER OF CHATTANOOGA BLACK SHALE

(L. C. Card No. Mic 59-2897)

Joseph T. Leonard, Ph.D.
The Pennsylvania State University, 1959

The chemical constitution of the organic matter of Chattanooga shale was investigated by oxidative degradation with moist, $3\frac{1}{2}\%$ ozone. Samples of the raw shale were ozonized in the absence of a solvent for 48- and 100-hour periods. This converted about 25% of the carbon to carbon dioxide. The ozonized shale was exhaustively extracted with ether and water. The ether extract contained oxalic acid, acetic acid, unidentified acids and a small amount of sulfur. The aqueous extract contained organic acids and ferrous sulfate. It was shown that the sulfur in the ether extract and the ferrous sulfate in the aqueous extract resulted from ozonolysis of the pyrite of the shale. The ether-soluble acids were in the form of a reddish-brown, amorphous, sticky mass having a caramel-like odor. Their molecular and equivalent weights indicated that they were largely dibasic. On the basis of their atomic hydrogen to carbon ratio and infrared spectrum, these acids appeared to be non-aromatic.

To avoid the difficulties caused by the presence of water-soluble mineral constituents mixed with the organic acids, a sample of mineral matter-free organic matter, or kerogen as it is called, was prepared by treating the raw shale with acids, alkali and by use of flotation techniques. The kerogen, which contained 1% of ash, was ozonized and extracted as above. The principal products were, as before, ether-soluble and water-soluble acids, which accounted for 50% of the carbon. Another 30% of the carbon was converted to carbon dioxide, acetic acid and oxalic acid. The ether-soluble acids were similar in appearance and composition to the acids obtained from the raw shale. Methylation with diazomethane followed by infrared analysis showed that they contained alcoholic hydroxyl and carboxyl groups. When treated with hot sodium hydroxide, about 20% of the nitrogen of these acids was liberated as ammonia. This indicated that these acids contained unsubstituted amide groups which probably resulted from ozonolysis of pyridine-type structures in the organic matter of the shale.

The water-soluble acids from the ozonized kerogen were brown friable solids. Their molecular and equivalent

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

weights indicated that they were predominantly tribasic acids. Methylation with diazomethane followed by infrared analysis of the methylation products showed that these acids contained alcoholic hydroxyl groups in addition to carboxyl groups. The ester methoxyl contents of the methylation products were approximately one third of the theoretical values calculated from the equivalent weights of the respective acids. However, by assuming that two of the carboxyl groups were in the form of anhydride structures and that only one carboxyl group was available for reaction with diazomethane, much closer agreement between the theoretical and experimental methoxyl contents was obtained. The assumption of the anhydride structure was based on the interpretation of the infrared spectra which showed the typical anhydride absorptions at 5.4 and 5.6 microns. The water-soluble acids also liberated ammonia on treatment with hot sodium hydroxide.

Empirical formulas were calculated for both the ether-soluble and water-soluble acids from their molecular and equivalent weights, ultimate analysis and hydroxyl and carbonyl contents. According to these formulas, the ether-soluble acids were essentially dibasic acids containing, on the average, 0.4 moles of carbonyl, 0.3 moles of hydroxyl and 2.1 atoms of oxygen which was assumed to be in ether linkages. The atomic hydrogen to carbon ratio and infrared spectrum indicated that these were non-aromatic acids. The empirical formulas of the water-soluble acids showed that they contained less than one hydroxyl and also less than one carbonyl group per average molecule. The acids also contained 2.5 atoms of oxygen which was assumed to be in ether linkages. The atomic hydrogen to carbon ratio of the nuclei of these acids suggested that they were non-aromatic in character.

In view of the fact that the ozonization products were essentially aliphatic hydroxy acids, it followed that the organic matter of Chattanooga shale was largely non-aromatic. However, the ease of nitration of the organic matter (during the removal of the pyrite from the raw shale with nitric acid) indicated that it had some benzenoid character, and the presence of amide structures in the acid products suggested that it contained some pyridine rings as well. Microfilm $2.00; Xerox $6.20. 128 pages.

OCCURRENCE AND ORIGIN OF THE PEG CLAIMS SPODUMENE PEGMATITES, KNOX COUNTY, MAINE

(L. C. Card No. Mic 59-2779)

Harold Wesley Sundelius, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor E. N. Cameron

The Peg Claims pegmatites are representative of a group of zoned, granitic, lithium-bearing pegmatites in which spodumene is present from wall to wall and is oriented normal to the walls. The pegmatites occur as discordant, steeply-dipping, tabular bodies in the Penobscot quartz-mica schist near the margin of the Waldoboro granite. Deflection of the schistosity and crumpling of the country rock occur around the pegmatites. A narrow, quartz-muscovite-tourmaline-apatite aureole is developed around each of the pegmatites, around each country-rock septum splitting pegmatite, and around most of the country-rock inclusions in the pegmatites. The pegmatites are zoned, and each may be subdivided into: (1) a quartz-muscovite border zone; (2) an albite-quartz-muscovite wall zone; (3) and an albite-quartz-spodumene-microcline core. Cross-cutting, fine-grained, quartz-albite-muscovite lenses occur within pegmatite cores.

The bulk composition of Dike 1 and the composition of each of its zones have been computed. SiO_2 and Na_2O contents decrease, and K_2O, Li_2O, Rb_2O, and Cs_2O contents increase from the walls inward. The bulk mineralogy and variations in the mineralogy from zone to zone of Dike 1 have been determined. Albite, quartz, and muscovite decrease, and spodumene and microcline increase from the walls inward. The An-content of plagioclase from Dike 1 ranges between 10% and 4% and decreases from the pegmatite walls inward. Determinations based on the muscovite-paragonite and two-feldspar geothermometers indicate that Dike 1 formed in the temperature range 350-500 degrees C. A decrease in temperature of formation from the walls inward is indicated.

Metamorphic differentiation is rejected as the mechanism of formation of these pegmatites. Although the constituents of the pegmatites could have been present in the country rocks, no simple correlation exists between their relative abundance in Dike 1 and their expected ease of extraction, ionic size, or concentration gradients with respect to the country rock. A lack of evidence of replacement along with evidence for emplacement of the pegmatites along fractures rules out metasomatism as the mechanism of emplacement. Deflection of the schistosity, crumpling of the country rock, and replacement of deformed schist by undeformed tourmaline crystals indicate that the compressional deformation of the country rock was associated with pegmatite emplacement. These features mitigate against secretionary growth of the pegmatites in dilatant openings. Concretionary growth of the pegmatites in solid rock is eliminated bacause of the difficulty of accounting for the internal structure of the pegmatites on this basis and because of a lack of evidence to indicate that the force of crystallization was adequate to provide the necessary space for the pegmatites and to deform the country rock.

The features of the pegmatites appear to be consistent with development by intrusion and fractional crystallization of a pegmatitic fluid. A genetic relationship between the pegmatites and the Waldoboro granite is suggested. Deformation of the country rock is attributed to forcible intrusion of the pegmatitic fluid along shears. Contact aureoles resulted from diffusion of certain constituents from the pegmatitic fluid into the country rock. The details of the internal structure of the pegmatites are consistent with fractional crystallization of a pegmatitic fluid in a restricted system. The bulk composition of Dike 1 and the composition of the central part of the same dike fall near the quartz-feldspar minimum in the 2000 kg/cm^2 equilibrium diagram of Tuttle and Bowen.

Microfilm $2.00; Xerox $6.00. 121 pages.

HEALTH SCIENCES, NURSING

THE DEVELOPMENT OF A PROFESSIONAL GRADUATE PROGRAM IN NURSING

(L. C. Card No. Mic 59-2610)

Majorie Snyder Dunlap, Ed.D.
University of Southern California, 1959

Chairman: Professor James D. Finn

The purpose of this investigation was to determine the nature of a proposed advanced professional graduate program for nurses.

Three major sources of data in this study included (1) characteristic practices of four professional graduate programs in Social Work, Mechanical Engineering, Public Administration, and Education; (2) functions of nurse teachers and administrators in graduate nurse programs; and (3) opinions of selected members of graduate faculties of nursing in representative higher institutions.

Catalogs and literature pertaining to the four professional programs were critically analyzed. One graduate faculty in nursing in a large university was studied by observation, diary analysis, and interview. A questionnaire was administered to a representative sample of nursing educators working at the graduate level throughout the United States. Twenty out of twenty-six accredited graduate nursing programs were studied, with a questionnaire return of 71 per cent.

Findings. 1. Characteristic practices of selected professional graduate programs: (a) clear-cut distinctions between the professional and academic research degrees were not always apparent. Generally, the Ph.D. degrees emphasized scholarly pursuits and advancement of knowledge and the professional degrees, the preparation of leaders; (b) acquisition of a general knowledge of a subject field, a specialized knowledge of a facet of that field, and competency in research were the design of the over-all program of study; (c) typical admission prerequisites were ascertainment of scholarship ability, a baccalaureate degree equivalent to the degree offered in the respective institutions, completion of course requirements for the master's degree, and successful professional experience; and (d) general requirements were three years beyond the baccalaureate degree, one year in residence, foreign language or statistical and research methodology, satisfactory completion of written and oral examinations over the general field, special field, and dissertation, and the presentation of an acceptable dissertation.

2. The data secured from the questionnaire corroborated the adaptation of the general pattern and requirements of other professional graduate programs to an advanced professional program in nursing. Further elaborations or modifications were (a) provision for both academic research and professional degrees; (b) educational experiences concentrated in nursing, including field experience; (c) flexibility in over-all design and requirements; (d) increased knowledge and skill in the areas of research, communication skills, human relationships, nursing and the sciences underlying it and related fields; (e) increased competency in the practice of nursing and a functional area; and (f) a master's degree in nursing as a prerequisite.

3. The major functions of nurse teachers and administrators involved in graduate programs in nursing, which have implications for curriculum development, are teaching, responsibilities related to teaching, administration, research, meetings and committee work, and publication. Nurse teachers devoted most of their time to teaching, and nurse administrators to administration, while both groups participated least in research. Nurse teachers ranked teaching as the most important function and research as the least important function for their own jobs, but the latter function shifted from last place to third in importance for the future preparation of nurses for these functions. Nurse administrators ranked teaching and administration as the first and second most important functions, respectively, for their own jobs, while research was placed in the last two ranks of importance both for their own jobs and for the future preparation of nurses.

4. Five areas of preparation were recommended as essential for the preparation of both nurse teachers and administrators: research, statistics, interpersonal relationships, current issues in the nursing profession, and group behavior. Many more areas of preparation, specifically involving curriculum processes, were recommended for nurse teachers, while only one area, administration, was more recommended for nurse administrators.

5. The areas with nursing content were all considered "best taught by nursing faculty," while the remaining areas were generally considered "best taught by faculty of other disciplines." Microfilm $6.05; Xerox $21.20. 476 pages.

HEALTH SCIENCES, PATHOLOGY

BOVINE PAPULAR STOMATITIS

(L. C. Card No. Mic 59-2740)

Richard Allen Griesemer, Ph.D.
The Ohio State University, 1959

Bovine papular stomatitis has not previously been recognized in the United States. The few reports in the literature are from Europe where, around the end of the nineteenth century, the disease was encountered during outbreaks of foot and mouth disease. The recent discovery of the mucosal complex of diseases has again focused attention on diseases of the mouth in cattle. The recognition of papular stomatitis and the development of diagnostic criteria are particularly significant since the lesions resemble those of some stages of foot and mouth disease

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the other vesicular diseases, and the mucosal disease complex. The purposes of this study were —

1. To report, for the first time, the presence of bovine papular stomatitis in Ohio.
2. To characterize the naturally occurring disease.
3. To reproduce the disease in calves.
4. To characterize the experimentally produced disease.
5. To test the pathogenicity of the caustive virus for laboratory animals and for tissue cultures.
6. To differentiate papular stomatitis from other diseases with which it might be confused.
7. To review the literature on non-vesicular viral stomatitides in cattle and to classify the diseases according to our present understanding of this group of diseases.

This study represents the first recognition of the disease in Ohio. Naturally occurring papular stomatitis was encountered as an intercurrent infection during the study of another disease of calves. The identity of the disease was confirmed by histopathologic study and reproduction of the disease.

Papular stomatitis is a mild, afebrile, viral disease of calves. Lesions are found in the mouth, on the margins of the nostrils, on the muzzle and skin around the mouth, and sometimes in the esophagus and first three compartments of the stomach. The principal microscopic changes are focal hydropic degeneration and acanthosis in the mucosa or epidermis. Macroscopically these foci are raised and often irregular on the surface, forming brownish papillary nodules and papillomatous plaques. The lesions often persist for several months. Affected animals do not have fever, anorexia, excessive salivation, leukopenia, or depression. There are no lesions on the feet or teats or in the abomasum or intestines. The morbidity is nearly 100 per cent in affected herds; fatalities have not yet been recorded.

The disease was reproduced in calves by contact, by inoculation of portions of lesions, and by inoculation of the virus isolated in tissue cultures. The experimentally produced disease was identical with the naturally occurring disease. Guinea pigs, weanling and suckling mice, and embryonated eggs were not susceptible to the disease. No cytopathogenic effects were detected in tissue cultures of bovine kidney, bovine lung, porcine kidney, monkey kidney, Hela, or guinea pig kidney cells. However, nutrient medium from the fifth passage in bovine kidney tissue culture cells, representing a dilution of at least 1×10^8 of the original affected tissue, produced the disease when inoculated into calves.

The literature of the world on non-vesicular viral stomatitides of cattle was reviewed and the significant differential features of the diseases briefly discussed.

Microfilm $2.25; Xerox $7.80. 170 pages.

HEALTH SCIENCES, PUBLIC HEALTH

A STUDY OF OPINIONS REGARDING HEALTH AND ILLNESS AS RELATED TO SOCIAL CLASS MEMBERSHIP

(L. C. Card No. Mic 59-1765)

Bruce Randolph Thomson, Ph.D.
The Florida State University, 1959

The purpose of this study was to test the null hypothesis that opinions regarding health and illness were independent of social class membership. (This study was a part of a larger project investigating opinions in seven major areas--health and illness, mental illness, welfare services, women working outside the home, child-rearing, recreation, and family-planning.)

The opinions sought were grouped under eight subhypotheses regarding (1) health expectations, (2) responsibility for health, (3) causes of illness, (4) symptoms of illness, (5) use of medical services, (6) use of hospital facilities, (7) physician-patient relationships, and (8) preventive medical care. Many of the items used were borrowed from schedules now being used in studies by Dr. Lyle Saunders (Colorado University School of Medicine) and the National Opinion Research Center. Later comparison with their findings is projected.

The study was carried on in a representative agriculture service station town (population 6,000) in South Georgia with a random 20 per cent sample of white housewives. The McGuire-White Index of Social Status-Short Form was used to assess social class position of the respondents. Chi square was the statistical model for determining dependence of the variables. For only two of the null subhypotheses--"symptoms of illness" and "use of hospitals"--could dependence be shown ($P < .05$). For two others--"responsibility for health" and "use of medical services"--no dependence could be shown. The remaining four hypotheses were found to have one or more items in which dependence was found. In every distribution, however, the upper classes were found to hold opinions more in line with contemporary thinking on matters of health and illness than did the lower classes.

The community as a whole showed relatively little sensitivity to contemporary ideas regarding health and illness. This was attributed (1) to its relative isolation from the more sophisticated standards of medical care, (2) to the relatively low educational status of the population, (3) to the influence of folk ideas which continue to hold sway in the community, and (4) to the continuing influence of many conservative and fundamentalist religious groups which place a strong emphasis upon the sin-illness complex.

The study pointed to the need for individuals to have more adequate criteria with which to judge the competence of medical and hospital services, and suggested the need for comprehensive health education among all strata in the community. Microfilm $2.00; Xerox $5.00. 98 pages.

HEALTH SCIENCES, SURGERY

STUDIES ON THE BLOOD-BRAIN AND BLOOD-LIQUOR BARRIERS BY RADIO-ISOTOPE METHODS, WITH SPECIAL REFERENCE TO THE APPEARANCE OF I^{131} IN THE CEREBROSPINAL FLUID OF MAN

(L. C. Card No. Mic 59-2375)

Gerald Leon Haines, Ph.D.
University of Minnesota, 1959

Nearly ten years have elapsed since the introduction of radio-active iodine as an aid in the detection of brain tumors. During this time there has been considerable advance in instrumentation and technique of radioactive counting. A review of the literature confirms personal experience that the procedure is useful in detection of brain tumors, although there have been dissenting voices, and the procedure has in no way replaced air study or angiography. In our hands, comparison of tangential counts of corresponding locations in each cerebral hemisphere, made by a single scintillation counter, rather than the use of multiple fixed tubes, has been the most accurate method of counting. A finding of ancillary importance is that tumor tissue tends to retain radioactive iodine longer than the surrounding tissue and the rate of clearance may be an aid in determining the type of tumor.

Iodine^{131} has also been detected by means of beta counting, in the cerebrospinal fluid of all patients tested who have received a dose of five microcuries of I^{131} albumin per kilo. The isotope appeared in significantly greater concentration in patients having brain tumors than in patients having chronic degenerative neurological disease. It appeared earlier and in greater concentration in lumbar fluid than in ventricular fluid and reached a fairly stable concentration therein about forty-eight hours after injection. A portion of the iodine has been found to be bound to protein.

Comparative counts of cerebral hemispheres were done in a series of patients before and after angiograms performed with 35% Diodrast. No significant increase in uptake of the injected hemisphere was found after angiography, except in those rare cases where hemiplegia occurred as a complication, thus indicating damage to the blood-brain barrier by the contrast media.

Further information concerning the nature of the blood-brain barrier has been sought with the aid of ultraviolet microscopy. Lylonphylized sections of brain tumors from patients who had received radioactive diiodofluorescein were examined under ultraviolet light. Fluorescence was found both in stroma and in tumor parenchyma. At times, particularly in ependymomas, the fluorescence was found to be more intense in the stroma than in parenchyma itself. However, in other tumors it was found to be distributed within parenchymal cells, and appeared in heavier concentration in masses of nuclear material. It seems apparent that the factor responsible for the selective uptake of iodinated fluorescein by tumor tissue is common to both stroma and tumor parenchyma, and is present in both nuclear material and surrounding cytoplasm.

Integration of data obtained in these investigations with that available in the literature suggests a revision in traditional concepts of the blood-brain barrier. It is herein regarded as embracing not only endothelium and intercellular cement of the blood vessel wall, but also the pia-glial membrane. Each is dependent upon the other and each may vary in the importance of its barrier function, according to the type and location of the toxic substance to which it is subjected. Inasmuch as the blood-brain and blood-liquor barriers are part of the same protective mechanism, and inasmuch as blood vessel walls comprising the blood-liquor barrier do not possess a pia-glial membrane, the endothelium and intercellular cement are regarded as possessing the most important barrier function.

Microfilm $2.00; Xerox $5.20. 105 pages.

HISTORY

HISTORY, ARCHAEOLOGY

CULTURE CHANGE IN THE CEBOLLETA MESA REGION, CENTRAL WESTERN NEW MEXICO

(L. C. Card No. Mic 59-2682)

Alfred Edward Dittert, Jr., Ph.D.
University of Arizona, 1959

Supervisor: Raymond H. Thompson

Archaeological investigations have been conducted in the district surrounding Acoma Pueblo in central western New Mexico from 1947 through 1952. The major studies have been concentrated in two localities, Los Pilares and Los Veteados, on the west side of Cebolleta Mesa. Other excavations have been carried out in Spider Canyon west of Acoma Pueblo and at the Pueblo of Acoma. Site surveys in these districts have yielded 258 sites of which 20 have been excavated to some degree. An opportunity to study the areal extent of the cultural manifestations defined through this research has resulted from the Acoma Land Claim case against the United States Government. It has been found that the district bounded, approximately, by Mt. Taylor on the north, the Continental Divide on the west, Alamocita Creek on the south, and the Rio Puerco (E) on the east forms a physiographic and cultural unit which is termed the Acoma Culture Province. Division of the province into six regions has been suggested. These regions are closely related when compared with surrounding districts; distinctions are due largely to contacts with different outside districts. The Cebolleta Mesa Region occupies a central position within the province and, although it lacks features found nearer the provincial boundaries, the culture changes are evident that have led to a modern pueblo.

A detailed analysis of the total material culture remains has been presented. This has shown an early occupation by Paleo-Indian groups culturally similar to those defined at Blackwater No. 1 Locality near Clovis, New Mexico. Later artifacts are referable to a San Jose complex and to a subsequent development, the Lobo complex. The following periods, the White Mound, Kiatuthlanna, Red Mesa, Cebolleta, Pilares, Kowina, Cubero, and Acoma Phases, show an unbroken development from the Lobo Period and a continual occupation of the Cebolleta Mesa Region.

Culture contact situations inferred from material remains include both site-unit and trait-unit intrusions. The former are evident during periods of rapid culture change. These include the Lobo Period and the White Mound, Cebolleta, Kowina, and Acoma Phases. Except for the influx of Mesa Verde peoples in the Kowina Phase and the varied groups who came in during the Acoma Phase, culture contacts are predominantly with groups to the south and west of the province. Many of the new items in the Kowina Phase may have had origins far to the southwest.

The material culture analysis has shown that contacts are only events which introduce new traits; integration is usually accompanied by syncretism. Effects on other traits in the culture can be seen as a result of the introduction of new items. Once a trait is established, replacement is slow and the form may be retained after additional similar types are introduced. Thus, accretion is more characteristic than loss or replacement.

The developments of some of the social forms have been traced through recourse to ethnological data and more recent information on social conditions. One important social form is seasonal dispersion which has evolved as a result of adaptation to local environmental conditions. Although there is evidence for seasonal dispersion and surface habitations throughout the periods when pottery is present, a formalized dichotomy of habitation is apparent by the Kowina Phase. The present Acoma satellite communities have developed from this social form. In addition, the paraphernalia used in curing, the use of scrying, and many religious ceremonies have ties to the past.

Microfilm $8.00; Xerox $26.80. 620 pages.

HISTORY, MEDIEVAL

ABRAHAM IBN DAUD'S SEFER HA-QABBALAH, A CRITICAL EDITION WITH AN INTRODUCTION AND AN ANNOTATED TRANSLATION OF THE FIRST PART

(L. C. Card No. Mic 58-3217)

Gerson David Cohen, Ph.D.
Columbia University, 1958

This work presents a critical edition of the Hebrew text of Sefer ha-Qabbalah (The Book of Tradition) written by Abraham ibn Daud ha-Levi of Toledo in 1160-1161. The new eclectic text, which is accompanied by a full critical apparatus, was derived after a collation of the fourteen known manuscripts, editio princeps and citations from the work by medieval authors.

The Sefer ha-Qabbalah is a history of Jewish oral, or Rabbinic, tradition from Biblical times to the Spanish academies of the author's days. Principally, the work aims to refute the contention of the Karaite heresy that Rabbinism is a post-Biblical innovation which can lay no claim to uninterrupted continuity. The work is patterned after Muslim historiography which defended religious tradition by classifying the authorities by time, place, and master-disciple relationship.

The text of the work consists of two distinct parts. The first, comprising two-thirds of the work, traces Jewish history and chronology from the creation of the world until the end of the Gaonic period in the eleventh century. The second portion gives a detailed account of Rabbinic learning in Spain and of the rise of Karaism on the Iberian peninsula. Since the first part is derived exclusively from literary sources, on the indentity of which there has been considerable dispute, and since this portion of the work has been least understood, this section has been translated and fully annotated.

The analysis of the text has indicated that Ibn Daud probably wrote his work in Arabic, while the Hebrew text is the product of some unknown translator's pen. Many of the obscurities in expression, as well as distortions of fact, are traceable to mistranslations of the original. An examination of Ibn Daud's chronology has indicated that he adhered consistently to Spanish-Jewish traditions and methods of dating past events. However, simultaneously Ibn Daud has deliberately altered a number of dates even of Biblical and Talmudic chronology in order to provide a symmetrical representation of the past. In Ibn Daud's scheme, each era must have its counterpart of identical length. Thus, the redaction of the Mishna is placed 500 years after the cessation of prophecy, and the beginning of the Gaonic age 500 years later. These two dates, which have evoked considerable modern discussion, are shown to be but two in a whole series of symmetrical and doctored figures. Finally, Ibn Daud's sources for his Biblical Talmudic and post-Talmudic data are identified. It is demonstrated that there is an indubitable connection between Ibn Daud's chronicle and the Epistle of Sherira Gaon of 986, even in those passages where the Sefer ha-Qabbalah is ostensibly at total variance with Sherira. Ibn Daud's account and errors can be traced to an intermediate source, probably the lost history of tradition of Nissim ibn Shahin. Ibn Daud's egregious errors on the Gaonic period are so consistent as to enable us to determine the nature of his source and the cause for his mistakes on the places of the presidency of the first four generations of Geonim. In addition to his Jewish sources, Ibn Daud drew considerably on Muslim and Christian works, among the latter being an unknown recension of the Mirabilia Urbis Romae from which Ibn Daud appropriated many of his bizarre facts on Roman history and archeology.

The translation, commentary and analysis of the sources are introduced by an examination of Ibn Daud's life and work and of the historical background of his anti-Karaite polemic. Microfilm $6.45; Xerox $22.40. 506 pages.

RABBI MOSES ALASHKAR AND HIS TIMES - 1466-1542

(L. C. Card No. Mic 58-3898)

Samuel A Turk, D.H.L.
Yeshiva University, 1958

This thesis is a biographical account of Rabbi Moses Alashkar (1466-1542), a Spanish savant, who fled the Inquisition, lived in Greece and North Africa, and finally settled in Jerusalem. Being a great Talmudic scholar, he was often consulted for his legal opinion on matters of Jewish law and practice. His book of responsa published in Ferrara, Italy in 1553, together with the books of responsa by his contemporaries Rabbi Jacob Berab, Rabbi David ibn Abi Zimra, and Rabbi Levi ben Habib, reflects the religious, social, cultural, economic, and political life of the Spanish refugees.

Alashkar was in the forefront of the many controversies in which the rabbinical authorities of his time were involved. The disintegration of the Jewish community in Spain gave rise to personality and jurisdictional conflicts among the refugee rabbis, as well as to a general moral laxity. The suffering and hardships endured by the Spanish refugees resulted in a greater interest in the study of mysticism and a decline in the rationalistic approach to Judaism. The attacks levied against Maimonides' rational philosophy caused Alashkar to come to the great master's defense.

Despite their persecution and their sufferings, the Spanish refugees--of whom Alashkar is an excellent example--made lasting contributions to Jewish knowledge and learning.

Alashkar's writings and those of his contemporaries have never before been comprehensively digested. This study reveals the historical material culled from those works. Microfilm $4.95; Xerox $16.80. 388 pages.

HISTORY, MODERN

AMERICAN POLICY IN GUATEMALA, 1839-1900

(L. C. Card No. Mic 59-2705)

Warren Albert Beck, Ph.D.
The Ohio State University, 1954

Caribbean relations have long been a favorite subject for American diplomatic historians. However, except for works on Anglo-American isthmian rivalry there has been little consideration of the development of United States policy in Central America. This important aspect of American foreign relations has been slighted despite the fact that Yankee commercial penetration in the area has been and will continue to be extensive. And strategic considerations, because of the isthmian transit routes through Nicaragua and Panama, has given the State Department a vital interest in the political stability of the Central American republics. American policy in the past has been, and in the future will probably be, the single most significant factor determining the course of events in these countries. The purpose of the dissertation, then, is to examine the basis of American policy in Central America in general, with special attention to Guatemala between the years 1839 and 1900.

Guatemala was in the nineteenth century and remains today the most important nation in Central America. This is true because it leads its neighbors in population and because of the prestige of its capital city. Guatemala City has long been called the "metropolis of Central America." The capital was assured of this pre-eminence because of its historical position as seat of the Captaincy-General during the colonial period and as capital of the short-lived United Provinces of Central America. In addition, Guatemala City has almost always been the seat of the diplomatic corps of all nations. Hence, American policy in Central America was largely directed towards this leading republic, and policy for Guatemala inevitably became general policy for all of Central America.

The study is based primarily upon the records of the Department of State in the National Archives. The Instructions to American Ministers were helpful in indicating official policy in Guatemala. The Despatches from American Ministers were even more helpful in that they reflected what the American diplomatic representatives desired our policy to be. In contrast to the clear, concise, and restrained official views found in the Instructions, the Despatches are voluminous and contain numerous expressions of militant nineteenth century American nationalism. In addition, published documentary collections, memoirs, and pertinent secondary works were used to supplement the basic primary material.

The record of American-Guatemalan relations from 1839 to 1900 indicates that American policy was unusually considerate. In fact, the official treatment which that republic received from the United States showed respect, tolerance, and understanding for the smaller and weaker nation. The consideration displayed toward Guatemala by the United States was doubtless the primary factor in keeping diplomatic relations between the two nations free from major misunderstandings. Then too, relations were helped by the cordial nature of the government in Guatemala during the last three decades of the century. For with the overthrow of the Conservatives in 1871 the administration in that republic was a liberal anti-clerical faction which looked to the United States as the leader of world republicanism.

The early period of American policy in Guatemala, that from 1839 to 1849, was marked by futility. This futility resulted from the lack of direct ship routes to the republic, and the inaccessibility of the capital city made it very difficult and sometimes impossible for the United States diplomats to reach their post. During the decade (1839-1849) only two diplomats, and those special agents, reached Guatemala City. The first of these was the prominent antiquarian John L. Stephens, who, unable to find a stable government to which he could present his credentials, devoted himself to archeological investigations. The second, General William S. Murphy, was received by the Guatemalan government in December, 1841, but left for home after only three months residence in the capital.

Despite the frequent absence of diplomatic representation at Guatemala City, Washington was kept well informed of developments in the country by Henry W. Savage, a private citizen, who acted in the capacity of an American

diplomatic informer. The despatches of Savage, as well as those of the diplomatic representatives of the 1840's, reflect great fear of British domination in Central America.

It was not until 1849, the year of the Treaty of Amity, Commerce, and Friendship, that formal diplomatic relationship were established between the United States and Guatemala. The ensuing decade was one in which antipathy between the two American nations appeared, a distrust American agents claimed was accelerated by British subjects who sought to control the Conservative regime of President Carrera. The American representatives were also aware that the clerical administration of Carrera looked with disfavor upon the Protestant republic to the north. Finally, this unfriendliness was caused by the unsavory influence of American filibusters such as William Walker.

During the Civil War in the United States this antagonism toward the northern republic continued, with Guatemala favoring the South. It was reliably reported that the Conservative faction in Guatemala was plotting to set up a monarchy with a Belgian prince playing the role of a Maximilian. That American relations with Guatemala grew no worse than they did could be credited to the competence of Minister Elisha Oscar Crosby. Having lived in California, Crosby understood Spanish customs as well as the language. Hence, he was better qualified than most others to represent the United States at Guatemala City during this difficult period.

It was not until the Conservative government was overthrown by the Liberals in 1871 that Guatemala was to be led by a faction friendly to the United States. From 1871 on the Liberal government was not only friendly but leaders such as President Barrios were such enthusiastic admirers of the United States that they set out to duplicate American institutions in their homeland. As a direct result of this changed attitude, American businessmen began investing in Guatemalan enterprises.

Though it was not until the decade of the 1870's that American policy in Guatemala was effective in promoting economic penetration, this was the chief reason originally for establishing diplomatic relations. In his instructions to General Murphy in 1841 Secretary of State Webster stressed the fact that the United States needed a source of tropical products and that Central America was the logical region to supply them. The fear of England in the decade before the Civil War was one of jealousy stemming from British domination of Guatemalan trade. However, a nation with a continent to conquer and an important domestic problem to settle could be expected to pay little heed to the trade possibilities in Guatemala.

In the post Civil War period American diplomats tried to arouse more interest in the economic exploitation of Guatemala. It was hoped by these diplomats that the State Department would inform the nation's businessmen of the opportunities they were overlooking in the isthmian countries. Minister Williamson compiled statistical records of Guatemalan trade to indicate the great gains to be derived from economic penetration and development. This trade-conscious Minister also attempted to learn why American merchants who did try to invade the Central American market did not fare so well as the British, German, and French. He concluded that Yankee traders refused to make proper adjustment to the different business conditions existing in the Spanish American republics. They refused to manufacture goods designed primarily for the Spanish market. The Americans were even accused of trying to unload on the Guatemalans shoddy merchandise which could not be sold in the States. Frequently, American goods were received at Central American ports improperly packaged to stand the long journey inland, a carriage usually by pack animals. Despite these shortcomings, the volume of American trade with Guatemala continued to increase.

Perhaps because of the influence of former Secretary of State Blaine, the Department instructed its minister in 1882 to convince the Guatemalan government of the benefits to be derived by permitting American investors to aid in the development of that economically backward country. This aspect of American policy in Guatemala was most successful, and numerous Yankees bacame actively engaged in the economic development of the Central American republic. Though a strong case can be presented against the economic exploitation which necessarily accompanied such activity, in fairness it should be noted that the forward progress of Guatemala would not have been possible without American investments.

With the influx of American money into Guatemala, the United States diplomats were kept busy untangling numerous legal problems. Whenever an American businessman felt that his rights were being infringed upon by the Guatemalan authorities, he attempted to make, and frequently succeeded in making, a diplomatic case out of his difficulty. Fortunately, most Yankee problems were of a trivial nature and did not greatly disturb the course of American policy. However, one legal entanglement, though outside economics, had considerable significance. This was the Barrundia affair, which led to the recall of American Minister Mizner in 1890.

General Barrundia, a former Minister of War who had been in political exile, sought to take advantage of a brief conflict between Guatemala and El Salvador and return to power in his homeland. His attempted invasion from Mexico having failed, Barrundia took passage on an American ship bound for Panama. When the ship put in at a Guatemalan port Minister Mizner ordered the ship's captain to surrender the political refugee to the Guatemalan authorities. The General was killed resisting arrest.

In his letter recalling Mizner Secretary Blaine, while vigorously defending the right of political asylum aboard ships, based the recall decision primarily upon Minister Mizner's interference in the domestic affairs of Guatemala. Incidentally, this case is often cited by authorities on international law when dealing with the question of political asylum. All of these legal experts agree that Minister Mizner erred in specifically ordering the surrender of a political prisoner. Some authorities, however, are of the opinion that Secretary Blaine was not entirely correct when he insisted that the decks of a neutral ship can not be violated to remove a political refugee.

The degree to which the Liberal regime in Guatemala relied upon the United States is well illustrated in the case of the Mexican-Guatemalan boundary controversy. Several thousand square miles of territory were in dispute between the two nations and, as so frequently happens in such controversies, national pride became far more important than the territory involved. If it had not been for the restraining influence of the United States, Mexico would undoubtedly have taken the entire area in dispute, and perhaps all of Guatemala. The controversy was settled in 1882, primarily because of the eagerness of President Barrios to obtain

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

Washington's support in creating a Central American Federation.

The most important single theme of American policy in Guatemala from 1839 to 1900 was the renewed effort to promote the union of the five Central American states. Originally the United Provinces of Central America had been organized in 1825 and dissolved in 1838; Guatemala formally declared its independence from the federation in 1847. As the most influential nation and the seat of both the colonial and federation governments, it was inevitable that Guatemala would be the key country in any effort to re-establish the union. Consequently, the American diplomats at Guatemala City were consistently instructed to promote the federation. In fact, in the instructions to American Ministers the State Department lost no opportunity to stress the theme that advancing the cause of Central American union was a cardinal tenet of American policy.

The Conservative regime (1839-1871) in Guatemala was strongly opposed to the federation, mainly because of its memory of the anti-clerical attitude of the government which had ruled the United Provinces of Central America. And as the American diplomats encouraged union, distrust of American motives and ultimate intent accounted for much of the unfriendliness displayed during the Carrera administration. With the advent of the Liberals to office in 1871, the State Department renewed its efforts to promote Central American union. President Justo Rufino Barrios (1873) thought of himself as the one to weld the five states into union.

In this tremendous undertaking Barrios was to rely heavily upon American support. At one time the Guatemalan President offered to sell the United States the Bay Islands so as to bring greater American influence into Central America, and thus promote his confederation scheme. In his dealings with the United States, however, the basis of Barrios' bargaining power rested upon the Nicaraguan canal rights. He promised to deliver these rights in return for support in his attempt to create a federation. On another occasion Barrios requested that the United States loan him two million dollars so that he might build an army to establish union. American Minister Logan even reported that the Guatemalan President was interested in a plan to create a Central American federation as a protectorate of the United States. Though a vigorous advocate of such union, Secretary Blaine cautioned the American Minister from encouraging any policy that would constitute interference in the domestic affairs of the Central American republics.

In 1882 President Barrios came to the United States, ostensibly to settle the Mexican boundary controversy. Though the documentary evidence is sketchy, informed students and scholars believe that the administration at Washington encouraged the Guatemalan leader in his plans for union. Unable to obtain his desired goal by peaceful means, Barrios announced a union of Central America in February, 1885, and prepared to fight to attain it. Perhaps Barrios had reason to believe the United States would support his attempt. Such, however, was not to be the case. The State Department declared that though it supported the cause of union, it would not condone the use of force in its achievement. On April 2, 1885, Barrios, Guatemala's greatest President, was killed on the field of battle.

With Barrios also died any hope of Central American union. American policy continued to support federation, and numerous attempts to accomplish it were made, but none was to have even a remote chance of success. Actually, of course, geographical isolation, which had originally caused the evolution of five distinct states, was the greatest barrier to the attainment of a successful Central American federation. Yet the effort of the United States to further union is an excellent example of the direction of American policy in Guatemala, for it was an attempt to promote an ideal which the United States believed was in the best interests of Guatemala in particular, and all of Central America in general. But, though the State Department believed in this ideal, it still instructed the American Ministers to promote the cause of union only so long as they could do so without interfering in domestic politics. In fact, the story of American policy in Guatemala from 1839 to 1900 fails to bring to light a single incident wherein the United States failed to conduct itself with due regard for the sovereignty of its smaller and weaker neighbor.

Microfilm $2.25; Xerox $7.80. 170 pages.

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THE SATSUMA REBELLION OF 1877: AN INQUIRY INTO SOME OF ITS MILITARY AND POLITICAL ASPECTS

(L. C. Card No. Mic 59-2833)

James Harold Buck, Ph.D.
The American University, 1959

Introduction. The first decade of the Meiji Era (1868-1912) was a time of epoch-making change in nearly every aspect of Japan's national life. Consciously imposed by the young samurai oligarchy of the Restoration Government, these changes involved destruction of the crumbling military feudalism of the Tokugawa regime and the establishment of a strong central government secure from internal military threats. The final, and most serious, of these threats was the Satsuma Rebellion. The defeat of the Satsuma rebels, a turning point in modern Japanese history, permitted the oligarchy to continue its transformation of Japan from a loosely-organized, feudal, agrarian country into a relatively centralized state in the initial stages of industrialization.

Statement of the Problem. The problem of this dissertation was to describe and to analyze the major military and political aspects of the Satsuma Rebellion. Secondary problems involved treatment of military feudalism, the causes and courses of the lesser revolts of the 1870's, and a succinct evaluation of how the Central Government's victory influenced subsequent military and political developments in Japan.

Method of Research and Procedure. The major research for this dissertation was done in Japanese language sources, the most useful of which were the comprehensive official records of the Imperial Japanese Army units which participated in the Rebellion and the collected writings of Saigo Takamori, leader of the Satsuma Army. The results of the research are presented both topically and chronologically. Early chapters treat the decline of Tokugawa feudalism, the "formal" abolition of feudalism by the

oligarchy, and the series of recurring crises which split irrevocably the Restoration Government. A middle chapter is devoted to the events which precipitated the Rebellion. Later chapters consider in detail the military operations, and a final chapter summarizes the causes of the Rebellion and offers an assessment of its results.

Results. Japanese sources proved reliable in determining in detail, the major military and political circumstances surrounding the Rebellion.

Conclusions. The reforms undertaken by the Restoration Government required the greatest sacrifices from the samurai class, but these were accepted generally except among the Western Clans. Futile, lesser revolts occurred in western Japan in 1874 and 1876. By early 1877, only Satsuma, which had remained quiescent during earlier revolts, continued to maintain its historical autonomy. Fearing an uprising in this "state within a state," the Central Government infiltrated spies into Satsuma and attempted to remove military supplies stored there. The coincidence of these two events, neither of which singly would have been likely to lead to civil war, caused Saigo, under pressure from extremist adherents, to march toward Tokyo to seek an explanation from the Government. Imperial Army forces blocked the route of march of the Satsuma Army and the eight-month civil war broke out in February, 1877. The Government victory over Saigo destroyed the vestiges of military feudalism in Japan; facilitated the assumption of greater power by proponents of strong military forces, especially Yamagata Aritomo; permitted far-reaching technical and organizational military reforms and the development of forces designed to advance Japan's interests on the continent of Asia; laid the foundation for the increasing influence of military officers on government policy for the next several decades; and resulted in the political unification of Japan to a degree never before attained. Microfilm $3.70; Xerox $12.40. 285 pages.

A HISTORY OF THE CHINESE COMMUNIST ARMY

(L. C. Card No. Mic 59-864)

Sin-ming Chiu, Ph.D.
University of Southern California, 1958

Chairman: Professor Theodore Chen

The Chinese Communist Army is different from other armies in modern Chinese history. Two characteristics of the warlord armies of recent times—the personal ambition of the officers and the mercenary nature of the men—are eliminated by a system of political controls. As a result, the Chinese Communist Army is subservient to the interests of the state and the Party.

Every unit in the army is controlled by a twin hierarchy of political workers. A party committee serves as the link with the party organization, transmitting party-government policies to the unit to be carried out by the unit political department or, on the lower levels, by one or more political officers.

Direct and indirect controls over the men are exerted by the political departments and political officers at all times. In peacetime, army personnel are engaged in many activities, some of which may appear to be recreational and social in nature but which actually serve a political purpose. In time of war, political workers seek to reinsure loyalty by inculcating hatred of the enemy and by constantly checking the combat conduct of the officers and men. The primary objective of political control is to condition the army personnel so that they become responsive to party calls to action, whether it be railway building or bond subscription. Occasional benefits bestowed upon war heroes and their familes and the exaltation of the soldiering profession tend to make the men feel a vested interest in the army and the state. Constant exposure to indoctrination and the part's demand for periodic public assertion of loyalty in the form of "ideological struggles" help create a singleness of purpose, which is to advance the interest of the state and the party.

Earlier intraparty struggles notwithstanding, the Chinese Communist Army has had a singularly stable leadership. Most of the officers, though by no means educated in military lore, have earned their laurels through actual combat. Unrestricted by formal military rules, these officers have improvised tactical methods best suited to particular situations. The command structure has been relatively flexible, and, as the occasion demands, commanding officers may be allowed a great measure of freedom.

Ideologically, the officer corps is united by the military thinking of Mao Tse-tung, hailed by the Communists as the "guiding genius" in the growth of the Communist Army. With less emphasis on weaponry than on man and space, Mao's military ideas, which proved successful against stronger enemies, may have far-reaching effects on the future development of the Chinese as well as other Communist armies.

All these factors contributed to the smooth transformation of the erstwhile guerrilla army into a regular national force. The first steps of modernization have been completed with the adoption of a military service law and the creation of naval and air arms. Though this army is yet untested in a real modern war, it may be expected that it will grow stronger with more trained personnel and modern material support.

Microfilm $4.70; Xerox $15.80. 366 pages.

THE UNITED STATES AND PANCHO VILLA

(L. C. Card No. Mic 59-2813)

Clarence Clemens Clendenen, Ph.D.
Stanford University, 1959

The objectives of this dissertation are to trace the relations between the United States and General Francisco Villa and to consider the effects of those relations.

Villa, an obscure bandit, joined the Madero Revolution against Diaz, and contributed materially to its success. He remained loyal to Madero during the Orozco rebellion of 1912, but was imprisoned and subsequently escaped into exile after a quarrel with General Victoriano Huerta. After the assassination of Madero and Huerta's usurpation of the Presidency Villa returned to Mexico and soon became an important revolutionary figure. He was nominally under the authority of Venustiano Carranza, but actually remained

an independent caudillo with a private army. Consequently, the United States found it expedient to deal with him on a quasi-diplomatic basis for several years.

During 1913 and 1914, while winning a series of spectacular victories, Villa was friendly toward the United States, and in April of 1914 he was influential in preventing Carranza from joining forces with Huerta to fight the United States. Nevertheless, his brutality in numerous of his acts caused the United States considerable diplomatic embarrassment.

Villa and Carranza quarreled late in 1914, in spite of efforts by the United States to keep them in agreement. President Wilson, faced with the dilemma of determining which of the rival leaders to recognize, finally decided in favor of Carranza.

Meanwhile, Villa had suffered a series of defeats, and in the autumn of 1915 met with disaster at Agua Prieta and Hermosillo. Ascribing his reverses to American Support of Carranza, Villa retaliated in March, 1916, by raiding Columbus, New Mexico. President Wilson immediately dispatched an expedition, for which there were numerous precedents, to break up Villa's forces. Carranza grudgingly consented to the expedition, but in short time became extremely obstructive. The situation thus created was so threatening that President Wilson mobilized the National Guard. The movement of the Guard to the Mexican border was confused, and revealed many weaknesses. Almost concurrent with the mobilization was a sharp clash between Americans and Carranzistas at Carrizal, Chihuahua. The danger of war, however, gradually abated, and early in 1917 the expedition was withdrawn, after accomplishing its primary mission of dispersing Villa's following.

While the expedition was withdrawing, Germany announced the opening of unrestricted submarine warfare. Berlin was almost certainly influenced by the belief that the Mexican situation proved the military impotence of the United States.

Between 1917 and 1919 Villa rebuilt his army, but carefully avoided offense toward the United States. Growing bolder, in May, 1919, he attacked Ciudad Juárez. American forces intervened, crossing into Mexico, and so completely routed Villa that he was never again a threat to the United States.

Villa's initial rise was made possible by the support of the United States, and his activities deeply affected American diplomatic problems, both with Mexico and European powers.

The writer has endeavored to reconstruct the story of the United States and Pancho Villa from contemporary evidence. In addition to the usual published sources, he exploited the newspaper collections in the Hoover Library at Stanford University and the Library of the University of California. He also had access to the private papers of President Wilson, General John J. Pershing, Major General Hugh L. Scott, and to the State Department, War Department, and Department of Justice files in the National Archives. Microfilm $6.75; Xerox $23.40. 532 pages.

TRADITION AND REVOLUTION IN MODERN CHINA: YEN HSI-SHAN IN SHANSI PROVINCE 1911-1930

(L. C. Card No. Mic 59-2817)

Donald George Gillin, Ph.D.
Stanford University, 1959

This is a study of the career and regime of one of the most prominent of the Chinese warlords, Yen Hsi-shan, the so-called "Model Governor" of Shansi Province, during the period 1911 to 1930. It has been undertaken in the hope of illuminating the history of the independent military regimes which sprang up in different parts of China after the overthrow of the Ch'ing dynasty in 1911.

The first chapters of the study describe Yen's education and his rise to power in Shansi. The son of an unsuccessful businessman, he entered upon a military career chiefly in order to secure an education at the expense of the government. While a student at the Imperial Military Academy in Tokyo he came under the influence of Sun Yat-sen and during the revolution of 1911 led an uprising in Shansi in support of the Kuomintang. The revolution and the events that followed it established Yen as the ruler of Shansi. Thereafter, he remained relatively aloof from the incessant fighting in North China, endeavoring to preserve his authority in Shansi by seeking the friendship of whichever one of the rival militarists seemed likely to triumph.

The bulk of the study concerns Yen's program to modernize and develop the resources of his backward and underdeveloped province. There is a chapter about his efforts to introduce a highly centralized form of government and arouse popular enthusiasm for his regime by setting up representative assemblies and adopting some of the other trappings of political democracy. Other chapters deal with his ideology, a somewhat careless synthesis of elements taken from many different systems of thought, his attempts to stamp out drug addiction, and his campaign to spread literacy among the masses. In addition, there is a description of his struggle to increase the productivity of agriculture and otherwise create a viable and expanding economy in Shansi, followed by a discussion of the reasons why he failed to achieve his objective. Inspired for the most part by what Yen had seen in Japan, these innovations were introduced largely in the hope that they would augment his power; However, they were considered unusually progressive by many of his contemporaries and won for Shansi the reputation of being the "Model Province." The final chapter relates how Yen became involved in a series of wars with other warlords which culminated in his defeat at the hands of Chiang K'ai-shek in 1930 and the destruction of much of what he had achieved in Shansi.

The picture that emerges from this study is that of a conservative and backward people struggling to adapt to the conditions of the modern world under the leadership of a man whose own naivete and antipathy to change were perhaps the most formidable obstacles in his path. Only by bringing about far-reaching changes in the structure of society in Shansi could Yen have eradicated the poverty of his subjects and only by completely re-educating them could he have dispelled their ignorance. He was too attached to the existing order to attempt the former and too enamoured of tradition and preoccupied with advancing his own interests to succeed in the latter. Nevertheless, by tampering with the groundwork of the established order he

unwittingly helped generate forces destined to alter fundamentally the structure of Chinese society. His career suggests that the so-called "warlord period" was not merely an era of fruitless strife but a decade which witnessed a series of changes so significant that without them the unification and rudimentary modernization of China that occurred after 1930 would have been impossible.

Microfilm $3.25; Xerox $11.00. 249 pages.

HISTORY OF FOREST INDUSTRIES IN THE LONGLEAF PINE BELT OF EAST LOUISIANA AND MISSISSIPPI, 1840-1915

(L. C. Card No. Mic 58-3973)

Nollie Wade Hickman, Ph.D.
The University of Texas, 1958

Supervisor: Dr. Barnes Lathrop

The longleaf pine belt in which is found two of the world's most valuable softwoods extends across southern Mississippi into Louisiana to the Amite River.

Commercial lumbering beginning in the late 1830's at the mouths of streams emptying into the Gulf became important by 1860. Expansion of the lumber industry from the early post-war period down to 1890 came with development of markets in the United States and in foreign countries. By the late 'eighties logging, rafting, and sawmill work had all but displaced the pastoral pine country economy.

Land policies of both the federal and state governments though designed to foster agriculture posed no great handicap to lumbermen who by 1890 had often through devious practices acquired most of the timberland.

The naval stores industry, of considerable importance after 1880, in business methods, production, and labor management changed little in the period 1860-1915. The lot of the Negro who performed almost all the labor in naval stores production was perhaps worse than any other class of laborers in the industrial system.

Lumbering reached its peak in the years 1890-1915 and in 1909 the state ranked third among the states in lumber production. This speedy growth was due mainly to migration of capital from the old lumber districts of the North and East. In the period 1909-1915 most of the lumber was manufactured by a few operators producing from 20,000,000 to 200,000,000 board feet annually. At Bogalusa the Great Southern Lumber Company built one of the largest sawmills in the world.

Most of the lumber was marketed in the United States though considerable quantities of superior grades went to overseas markets. Lumbermen to control distribution established trade associations for the purpose of creating uniform grades, fixed prices, and terms of sale. Establishment of uniform grades was achieved but due to excess production of the over-expanded industry, efforts to fix prices proved impossible.

Railroad construction was generally a direct outgrowth of forest industries. Lumbermen in a number of instances converted logroads into common carriers, thus creating a transportation system that penetrated almost every locality of the pine country. Long and bitter controversies between lumbermen and railroads over freight rates and tapline allowances played an important role in giving the moribund Interstate Commerce Commission real powers in regulation of interstate transportation.

Native whites and Negroes who provided the bulk of labor in the booming lumber industry were according to some lumbermen both scarce and inefficient in the years 1899-1907. Labor scarcity motivated many lumbermen to bring in workers from the North. The Depression of 1907, however, converted the perennial labor shortage into a surplus. Wages of workers were low and hours of work long, and labor conditions were generally bad in the mills and logging camps.

Ownership of timberland and sawmills by a few people led to legislation that limited land acquisition which was later held unconstitutional by the courts. Few lumbermen made any attempt to reforest their lands, contending that taxation made such a project unprofitable. They tried unsuccessfully to dispose of their worthless cutover lands to immigrant farmers. Failure of immigrants to produce agricultural crops led to reforestation of cutover lands.

The big mill period of lumbering came to an end around 1930, but forest industries continued to be the most important industry in the state. Other industries important in the economy of the section were originally financed from capital created in the period of large-scale lumbering.

Microfilm $6.25; Xerox $21.80. 492 pages.

SAINT FRANÇOIS DE SALES AND THE PROTESTANTS

(L. C. Card No. Mic 59-2854)

Ruth Kleinman, Ph.D.
Columbia University, 1959

François de Sales, a native of Savoy and prince-bishop-in-exile of Geneva from 1602 to 1622, was one of the leading figures of the Counter-Reformation. To the religious revival that animated French Catholic circles in the first half of the seventeenth century, he contributed a greater emphasis on the part religious feeling and practice should play in secular life. He did not, however, confine his efforts to the renewal of religious sentiment among the Catholic laity; by personal inclination as well as official duty, he was concerned with the conversion of Protestants. François de Sales has, in fact, been hailed by some historians as a pioneer of peaceful means of conversion, relying on appeals to the conscience of Protestants rather than on the use of force.

This estimate is inaccurate. When dealing with individual Protestants, François de Sales indeed appealed to conscience and religious sensibility, and often successfully. But where Protestants in general, and especially Protestant minorities in Catholic states were concerned, he was willing to supplement spiritual means of conversion, such as public preaching and private exhortation, with political and economic pressure. Besides, François de Sales did not regard the conversion of Protestants as a purely ecclesiastical problem. His mission in Chablais, a Calvinist province of Savoy situated near Geneva, and his efforts to obtain the re-establishment of the Catholic Church in Geneva, illustrate his methods of dealing with Protestantism

on a large scale and his convictions regarding the role secular power ought to play in religious affairs.

The inhabitants of Chablais were reluctant to change their religion, not only by reason of personal conviction, but also through fear of reprisals from Geneva and Berne. When preaching failed to move the people, François de Sales requested the co-operation of the duke of Savoy, to add material weight to spiritual arguments. François de Sales did not go so far as to advocate the use of physical force, but he was willing to employ political pressure, economic discrimination, and exile, and he recommended such measures to the duke. The conversion of Chablais was ultimately accomplished by a combination of religious and political means.

The support of the duke of Savoy did not suffice, however, in the case of Geneva. France joined Geneva in opposing a change of religion that would have entailed the loss of the city's independence. According to all evidence, François de Sales did not take an active part in the Savoyard attack on Geneva in 1602. But in the course of his career he forwarded a variety of projects for seizing the city to the duke of Savoy, and repeatedly urged that the Catholic princes of Europe apply political pressure and even threats of war, to induce Geneva to abandon Calvinism.

Although François de Sales' campaign against Calvinism in Chablais and Geneva fitted well into the policies of the house of Savoy, he was not merely a tool of secular power. He did believe the state and the Church to be interdependent and obliged to mutual support, so that it was the duty of Catholic rulers to suppress heresies in their realms. In so doing, Catholic princes would also serve their own political interest, for François de Sales considered Protestantism as much a danger to the state as to the Church. Convinced as he was of an indissoluble connection between Church and state, between religion and secular life, François de Sales believed it legitimate, when religious appeals for conversion had been tried and had failed, to employ all forms of pressure short of physical violence and open war. Microfilm $2.75; Xerox $9.40. 210 pages.

THE AMERICAN ATTITUDE TOWARDS THE BRITISH EMPIRE FROM 1919 TO 1922 -- A STUDY IN THE DIPLOMATIC RELATIONS OF THE ENGLISH-SPEAKING NATIONS

(L. C. Card No. Mic 59-2387)

Neville Kingsley Meaney, Ph.D.
Duke University, 1959

Supervisor: Richard L. Watson

This dissertation is a study in the diplomatic relations of the English-speaking nations. In particular, it attempts to show the American government's attitude towards the British Empire from 1918 to 1922. During this period the British Empire's constitution underwent great changes. New conventions for regulating the relations between the Dominions and Great Britain were established. The 1917 Imperial Conference decided that Imperial foreign policy should be shaped through the joint and continuous consultation of the governments of the Empire. This experiment with an Imperial "cabinet of cabinets" lasted in an ill-defined form until the Prime Minister's Conference of 1921. It foundered on the rock of conflicting geo-political interests.

However the American government's attitude towards the British Empire, in this unique period of dynamic change and experiment, was primarily one of ignorance born of indifference. The Administration was not informed of the important results of the 1917 Imperial Conference. At the Paris Peace Conference in 1919, the American delegation found that it was impossible to avoid dealing with the questions of the constitutional relations of the members of the Empire. After they had seen in practice the influence of the Dominions on Great Britain and Imperial policy, they could not refute the evidence of their eyes. At first they had resisted Dominion demands but later reluctantly they agreed that the Dominions should be full members of the League of Nations and the International Labor Organization. The practical experience of Wilson and House at Paris convinced them that the Empire was undergoing a radical constitutional metamorphosis. Reflecting briefly, they thought it might very well be pointing the way to the disintegration of the Empire.

Returning to the United States, the Peace Treaty was placed before the co-ordinate arm of government. The enemies of the Treaty in the Senate picked on the British Empire's six votes in the League as a major point of criticism. Though the debate was marred by the most blatant partisanship, nevertheless the Empire's constitution became a matter of public importance and popular interest. The large majority which supported reservations to curb the voting influence of the Empire in the League was some indication, though an inadequate one, that the Senate was unconvinced by Wilson's description of the new Empire which had been revealed to him at Paris.

The Harding Administration elected in November, 1920 had to re-learn the lessons of 1919. After the rejection of the League, Americans had become apprehensive about the naval rivalry between the United States, Japan, and the British Empire, and also about the possible renewal of the Anglo-Japanese Alliance. By August of 1921 the Administration had come to appreciate the independent role which the Dominions played in the formation of Imperial policy. This knowledge was shared with the Senate majority and minority leaders who were members of the American delegation to the Washington Conference in November, 1921. At this Conference the Americans were most solicitous of the Dominions' views.

In short the thesis of this dissertation is that the American government was, in a broad sense, ignorant of the changing constitutional framework of the British Empire. Certain factors help in some measure to explain this ignorance. On the whole the American tradition of isolation and self-sufficiency caused them to be excessively concerned with their own affairs. Foreign policy was too often a mere instrument of domestic and partisan politics. Although, or perhaps, because the United States was associated more closely with the British Empire than with any other power, the American government, generally speaking, took for granted the British Empire's constitutional structure. Only where constitutional changes impinged directly on their own immediate international interests did they pay any attention to them.

Microfilm $5.50; Xerox $19.40. 431 pages.

A DIPLOMATIC HISTORY OF THE PHILIPPINE REPUBLIC

(L. C. Card No. Mic 59-2825)

Milton Walter Meyer, Ph.D.
Stanford University, 1959

Four successive administrations of the Philippine Republic since 1946 showed remarkable similarity in the pursuit of the vital interests of the new nation. The course of Philippine diplomatic history marked military and economic orientation toward the United States, political alignment with the West, appreciation of the Asian setting and Latin haritage, and commercial expansion with the non-Communist world.

Permanent factors conditioned the nature of the pursuit: Geographic location in Asia, racial and cultural affinity with Asian neighbors, and historic links with Spain and the United States. Immediate conditions also influenced national tactics in foreign affairs: political and economic conditions resulting from World War II, the strong international power position of postwar United States, and the personalities and temperments of the four Filipino presidents.

The administrations used varied means to promote similar ends, but all were preoccupied with implementation of national security, full and absolute sovereignty, and complete independence. Toward the United States, the Philippines stressed past relationship and the wartime experience of mutual suffering for a common cause. Liberals and Nacionalistas sought enhancement of the welfare of their people through American programs of trade and aid. Politicians in the Philippines were accepted as they were in good graces of the United States -- no critic of American friendship ar alliance could rise to a position of national leadership.

Toward other Western states, Filipino officials emphasized the affinity of democratic ideology. Among fellow Asians, they underscored racial similarity, geographic propinquity, and, in the early years of the Republic, sympathy in political struggles for independence. In the non-Communist world, they sought to expand the export markets to sell increasingly diversified Philippine products as a means to finance both imports and domestic development schemes.

Philippine diplomatic achievement fell short of desire. The Republic failed to receive as much as it felt it deserved from the United States. It obtained neither continued free trade nor ironclad pledges of automatic military protection. For Filipinos, it was difficult to realize, that, except for a temporary -- and then only partial -- American hypnosis by Magsaysay magic, the United States had tempered sentiment with realism. Nationalism on the part of the Filipinos was met with nationalist firmness on the part of the Americans.

Disappointment was compounded. Primary Western orientation helped to render Philippine diplomacy suspect in Asia. The Republic sought to promote Asian understanding of the Philippine outlooks, but by the same token it proceeded to isolate itself from the majority of Asian neighbors. Recognizing necessary dependence on the United States for a militant anti-Communist stand, administration spokesmen showed more interest in a strong American military posture in Formosa than in the existence of the Chinese Nationalist Government there. The Philippines refused to recognize the Chinese Peoples Government on the mainland.

The Philippines refused to subscribe to the neutralist policies of Indonesia, Burma and of Cambodia. It had little in common with the Asian giants, Indonesia and India. It experienced difficulty in escaping from the bitter memories of its wartime relations with Japan.

The Philippines sought the widest possible association with its Asian neighbors, but its quest was limited by its historical orientation toward the United States and by its ideological preference for anti-Communist governments. It became a pillar of SEATO. and as the Philippines became overwhelmed with the responsibilities of independence, it found less occasion to act as spokesman for peoples who had not achieved independence. This conservatism was increasingly apparent in the United Nations. Spokesmen for the Republic of the Philippines staked a special claim to the title of "bridge between the East and the West," yet the new nation seemed never to understand fully the one or the other. Its major preoccupation -- and its major achievement -- was rather in the development and perfection of its own national character and soul.

Microfilm $7.45; Xerox $25.60. 586 pages.

THE NEGRO IN LOUISIANA SINCE 1900: AN ECONOMIC AND SOCIAL STUDY

(L. C. Card No. Mic 59-2450)

Leedell Wallace Neyland, Ph.D.
New York University, 1959

Adviser: Ralph B. Flanders

This study is an historical survey and synthesis of the social and economic aspects of Negro life in Louisiana since 1900. The main concern is to bring together concrete historical data which should aid in understanding more thoroughly this distinct segment of Louisiana's heterogeneous population. Through a presentation and analysis of population trends, agricultural and non-agricultural pursuits, educational development, religious and fraternal organizations, and non-institutional phases of life, the writer treats the varied experiences of Louisiana Negroes from the turn of the century to the present time. The political activities are omitted unless absolutely essential for clarification.

The order of treatment is primarily chronological and topical. The research procedures for this study consisted of several parts. Interviews were held with Louisianians, who by position and experience, possessed invaluable knowledge of a given set of phenomena. Several contacts were made with private and public agencies for the use of archives, personal records and manuscripts. Library research consisted mainly of newspapers, pamphlets, books on Negro life, Census reports, professional journals and special unpublished studies. Private correspondence with interested parties was also utilized to facilitate research.

This study revealed several important trends. First, the Negro population was increasing but at a decreasing rate; migration rates were high, urbanization was increasing; male and female ratios were becoming more

disproportionate; and birth and mortality rates were decreasing. Secondly, Negroes in agricultural pursuits decreased in numbers with the introduction of technology on the farms, and a corresponding rise in non-agricultural pursuits was recorded. Businesses were generally small segregated establishments, which, like the professions, depended almost exclusively upon Negro clientele. Thirdly, the major gains in eliminating the differentials between whites and Negroes in the field of education were made during the last two decades. Fourth, churches, schools, and secret societies provided the chief sources of social and cultural outlets. While these organizations were often expected to assume leadership roles in improving community affairs, by and large, they were conservative institutional agents that accepted the status quo.

It is practical to conclude that Negroes in Louisiana have made considerable progress since 1900 in practically every facet of economic life, and have shared in increasing proportions in the social and cultural activities of the state. Although the period might be characterized as a progressive era for Negroes, they did not realize equal economic status with whites, nor did they rise above the traditional segregation-caste patterns. Progress in the field of race relations have developed at a most uneven pace and there were no indications that racial conditions would be significantly ameliorated in the near future.

Microfilm $2.85; Xerox $9.80. 220 pages.

THE WHALING PORT OF SAG HARBOR

(L. C. Card No. Mic 59-2593)

William R. Palmer, Ph.D.
Columbia University, 1959

Sag Harbor, New York was one of America's oldest and most important whaling ports. This was natural because organized whaling began a few miles from the port and the eastern end of Long Island in 1644. For the next seventy years Long Island farmers made a tidy profit from shore whaling during the winter months. In the first half of the eighteenth century the whale pods began to avoid the coast and Long Islanders were forced to make longer ocean voyages to find them. This required larger vessels and the development of eastern Long Island's only good port, Sag Harbor.

The growth of Sag Harbor and its early whaling industry is developed chronologically to 1820. Original materials are then used to describe Sag Harbor whaling in terms of the crews, ships, voyages, captains and whaleship owners. This method is also used to report life and working conditions aboard the vessels and crews and ship owners. The contributions of such Sag Harbor whaling captains as Cooper and Roys are related in some detail.

The significant period for Sag Harbor whaling was the period from 1840-1850. Rising prices for whale products caused the fleet to expand but since the whales had retreated to remote corners of the Pacific and Indian oceans, it took longer and longer to return with a "full ship." Even while the industry was growing, the margin of profit for both owner and whaleman grew less. In 1847 about one million dollars worth of whale products arrived at Sag Harbor but the ship owners lost some seventy-five thousand dollars that year. It comes as no surprise that more and more owners began to sell their ships and quit the industry.

Seeking to explain what happened to Sag Harbor whaling, local historians have long maintained that the discovery of gold in California and petroleum in Pennsylvania was the culprit. It has been overlooked that Sag Harbor whaling was failing before either of these events took place. The attempts of the former whalemen to find gold in California and to start a local cotton mill are described.

Sag Harbor whaling was like yet unlike whaling from other American ports. This study helps document and question some of the traditional ideas about the industry. The standard works of Beale, Bennett, Browne, Cheever, Davis, Hohman, Macy, Stackpole and Starbuck have been consulted, but the work is primarily based on town records, local histories, journals, logbooks, letters and newspapers found in Sag Harbor, East Hampton, Southampton, Riverhead and Mystic, Connecticut.

Microfilm $4.30; Xerox $14.40. 335 pages.

THE RUSSIAN ADVENTURE: BELGIAN INVESTMENTS IN IMPERIAL RUSSIA

(L. C. Card No. Mic 59-2756)

Edward F. Yurick, Ph.D.
The Ohio State University, 1959

A study of Belgian investments in Russia affords an excellent example of the international movement of capital from a highly industrialized country to a "backward" one within the limits of a clearly defined time period. More significantly it demonstrates the important part that Belgian capital played among foreign investors in the industrial revolution of imperial Russia.

As the title suggests this study is written primarily from the "point of view" of Belgium, because the primary sources used are almost exclusively Belgian. Pertinent industrial developments in Russia as a whole are surveyed to provide the proper background for Belgian investments and a basis for comparison with the industrial evolution of southern Russia where Belgians concentrated the largest part of their investments.

Following the introductory chapter which reviews pertinent economic developments in Belgium and Russia from 1860 through 1894, the circumstances and factors which created the union between Belgian capital and Russian industry during the years 1895 to 1900 are analyzed. The extent and role of Belgian capital in heavy industry in southern Russia is discussed in detail and illustrated with specific examples of individual companies. Investments in other industries in Russia as a whole receive a more summary treatment.

Two chapters for the years 1900 through 1906 include a discussion of the causes of the Russian depression of 1900-03, the solutions proposed by both official and private circles in Belgium and Russia, the proposals implemented by the Russian government and by the industrialists themselves, and the effect of the depression and the events of 1904-06 on Belgian investments in Russia. The last part of the study consists of a general survey of the years 1907 through 1917: measures adopted by Belgians to minimize of eliminate the mistakes of investors prior to

the depression, the extent and nature of Belgian investments in Russia during these later years, and the developments in Russian industry which affected the course of Belgian enterprises prior to their confiscation.

Essentially this study demonstrates that Belgian capital, along with that of other foreign countries, played a significant role in Russian industrialization, particularly in the Donets basin, and that for a number of years Belgian capital exceeded that of other foreign investors. In addition, this study offers other conclusions and evaluations of the effect of these investments on Belgium on the one hand and Russia on the other.

Microfilm $2.90; Xerox $10.00. 224 pages.

THE DESTRUCTION OF THE ROMAN CATHOLIC CHURCH IN RUSSIA, 1917-1923

(L. C. Card No. Mic 59-2521)

James J. Zatko, Ph.D.
University of Notre Dame, 1958

During the period of War Communism, 1917-1921, the Catholic Church was confronted with the following problems: the nationalization of church property and funds, the separation of church and state with the resulting complications in the administration of church goods and buildings, the problem of the Polish-Soviet War. The use of terror weakened the Church considerably by the exile of bishops, priests, layfolk, especially of the gentry who played a leading role in the social and political life of the area. The most important figure exiled at this time was Archbishop Edward Ropp, the archbishop of Mohylew.

The period of the New Economic policy, which lasted from 1921 to 1928, saw the destruction of the Catholic Church as an organized institution in Russia. The occasion of the action against the Church was the renewed demand of the government for agreements about the use of church buildings and goods for services, agreements which the clerical leadership of the Church felt were not consanant with the Canon Law; together with this the famine provided the occasion for the seizure of church valuables allegedly for famine relief. This also was resisted by the clergy provisionally, that is, until the consent of the papacy had been obtained. The consent of the papacy did not suffice to save the church from destruction. The climax came in the great trial of March, 1923. The Archbishop Administrator of Mohylew, John Cieplak, was condemned to death, but his sentence was commuted to ten years of solitary confinement; he was exiled in 1924. The vicar general of the archdiocese, Monsignor Constantine Budkiewicz, was condemned to be shot and was executed.

The Bolshevik state, therefore, completed the work of the tsars; the driving power behind the destruction was the inherent quality of a totalitarian state to demand total commitment on the part of its subjects; the hostility of communism to religion as an opium of the people and as a weapon of exploitation; and the determination of the government not to tolerate an institution that seemed the symbol of Polish nationalism.

The sources are: the Cieplak correspondence of 1922-1924, published official documents (governmental and ecclesiastical), unpublished reports in the National Archives, the press of the period, and the memoirs of participants.

Microfilm $4.80; Xerox $16.00. 374 pages.

HOME ECONOMICS

A STUDY OF HOME ECONOMICS GRADUATES AT MORGAN STATE COLLEGE, BALTIMORE, MARYLAND, FROM 1944 TO 1953: AN INVESTIGATION FOR CURRICULUM DEVELOPMENT.

(L. C. Card No. Mic 59-1044)

Theresa Kennedy Brown, Ed.D.
New York University, 1958

This investigation is a follow-up of 72 out of 91 graduates in home economics from 1944 to 1953, who had completed the requirements for a Bachelor of Science degree at Morgan State College, Baltimore, Maryland. The study was designed to secure, organize, and interpret data from these graduates for the purpose of improving the home economics curricula.

The techniques used for collecting data were questionnaires and structured interviews. The data collected were concerned with the graduates' personal, family, home and community life; their post graduation history; and their reactions to the training received at Morgan State College.

The findings indicated: (1) that the home economics curricula were not meeting adequately the needs of all students; (2) that some courses were not functional and practical enough; (3) that some graduates received more professional and personal benefits from the curricula than did others; (4) the physical facilities in the home economics department were inadequate; and (5) that 56 graduates would remain in some phase of home economics if they were to repear their formal training.

Several implications for curriculum improvement were: (1) the need for enriching certain existing courses; (2) the need for more counseling, vocational guidance and information about professional and counseling, vocational guidance and information about professional and occupational opportunities in home economics; (3) the need to make course experiences more practical and realistic; (4) the need for improvement of physical facilities; and (5) the need for continuous follow-up of home economics graduates.

The major conclusions may be summarized as follows: (1) certain pertinent and common factors discovered in the graduates' personal, family, home and community life may be suggestive to the home economics faculty for help in

viewing the curricula and for determining which factors to emphasize in the various courses; (2) the professional and occupational distributions of graduates may be of value in determining curricula for the home economics program and for directing students to pursue certain curricula outside the area of home economics in a liberal arts college; and (3) the evaluation by graduates of the home economics program as a whole indicated that home economics faculties re-examine frequently their programs to discover whether they are meeting both professional and family living needs.

In light of the purpose of the study, the analyses and interpretations of the data, recommendations were proposed for improvement of present practices in regard to: (1) curricular offerings; (2) guidance services; and (3) physical facilities.

Microfilm $3.40; Xerox $11.60. 264 pages.

THE USE AND MEANING OF FOOD IN FAMILIES WITH DIFFERENT SOCIO-ECONOMIC BACKGROUNDS

(L. C. Card No. Mic 59-2909)

Jane Louise Rees, Ph.D.
The Pennsylvania State University, 1959

Purpose

The purpose of this study was to determine some of the value considerations used by homemakers in relation to food and family meal, the goals they hope to achieve and the obstacles encountered in attempting to reach those goals. The study investigated differences in these concepts among homemakers in various status positions.

Procedure

Families with at least one child in the elementary school, grades one through six, were selected for study. School records were used as the source of eligible families. The sample was chosen by using a table of random numbers. Two hundred ten interviews were successfully completed.

The relationship of the status position of homemakers to differences in values, goals and obstacles was analyzed in two ways. One method divided the sample into two socio-economic categories by ranking each family on each of the following factors: education of the homemaker, occupational prestige score of the husband, family income, and formal participation score of husband and wife. The rank positions for each family were summed and the families reordered on the basis of this score. The median rank score was used as the dividing point between the upper and lower socio-economic category. The second method of analysis considered the relationship of each variable used in arriving at the two socio-economic categories to the values, goals and obstacles expressed by homemakers.

The chi square test, coefficient of contingency and analysis of variance were the statistical techniques used in the analysis.

Findings

Nutrition and family preference were the values most likely to be given consideration in the selection of family meals. Homemakers in the upper status categories, particularily those with more formal education, were somewhat more likely to mention nutrition than those in lower status categories. Apparently these respondents were aware of the importance of both considerations. Good nutrition can only be achieved if the food is eaten. Therefore achievement of adequate nutritional standard can occur only when family acceptance as well as the principles of nutrition are considered.

Emphasis on the aesthetic contribution of food tended to be associated with homemakers in the upper status positions rather than with those in lower positions. This greater concern for the aesthetic was reflected in the food served and the type of table services used. Homemakers in upper status positions were also more likely than those in lower status positions to give special attention to individual family members and to use time saving practices and products.

In all status positions homemakers tended to use food as a means of securing family approval but the food used varied somewhat.

In summary, it appears that the factors studied do not operate independently but interact in influencing the homemaker's use of food associated in family meals. It would seem that values with family meals must be considered if food habits are to be changed through education.

Microfilm $2.00; Xerox $6.40. 131 pages.

JOURNALISM

A CHECKLIST OF GERMAN NEWSPAPERS IN MISSOURI UP TO 1940

(L. C. Card No. Mic 59-2559)

Alvis Avelino Dunson, Ph.D.
The Ohio State University, 1954

Only a few attempts have been made in Missouri to catalogue German newspapers and periodicals. Those lists were for the purpose of covering limited periods of publication in connection with the history of the State of Missouri, for the libraries and the State Historical Society in Columbia, Missouri. The present work was undertaken to ascertain a chronological list of all German newspapers and periodicals published, dating from 1835 up to 1940. To acquire the data and information bearing on German newspapers and periodicals, the writer employed a questionnaire for three towns in which German newspapers were at some time in publication. For the remaining data and information visits were made to nineteen other towns and

cities; libraries in St. Louis, Jefferson City, and Kansas City were used, as were the private collection of Mr. Joseph Sailer of Jefferson City and the facilities of the State Department of the Secretary of State. The facilities of the State Historical Society in Columbia and the Missouri Historical Society of St. Louis were used. As a result of those efforts it was disclosed that the number of German newspapers and periodicals published in and between 1835 and 1940 was 187, and out of that number there were published in 1940 one newspaper, Die deutsche Wochenschrift, two religious periodicals, Der Friedensbote and Der Lutheraner, and one women's periodical, Die Abend Schule.

St. Louis had the largest number of publications because it had the largest number of German inhabitants; by 1860 there were 65,936 Germans living in the city and St. Louis county. Over the period of 105 years, there were published in St. Louis 39 German newspapers, five of them humorous, and seven religious; 81 German periodicals, 58 of them religious, 11 ordinary (that is, partly entertaining and partly informative), 10 miscellaneous, and 2 women's journals. Kansas City ranked second with 11 German newspapers. Jefferson City, the capital of the state, and Washington each published 6 German newspapers, while the other towns published from one to five German papers.

The writer has endeavored to give dates of establishment, suspension, change of name or political party, mergence, discontinuation, and, in most cases, the causes for suspension and discontinuation. Most of the German newspapers and periodicals traceable in Missouri belong to one of four categories: political, religious, humorous, and miscellaneous.

The study was divided into four chapters. The first chapter deals with early Missouri and its growth from a part of the Louisiana Territory into a State of the Union. Further, with its populace: Indians, French, Spaniards, Americans, and, especially, the Germans, who came to America mostly through the inducements of Gottfried Duden, seeking freedom of worship and freedom from political bondage.

Chapter Two deals with early German newspapers, and with the history of the oldest German family paper in the State, a newspaper whose history it is hard to separate from the history of its founder. In recording this paper's history, the writer has given various incidents in its career: its stand for Abraham Lincoln for president, its stand against slavery in the face of slaveholders, the burying of the printing press to keep the proslavery element from destroying it while the editor was away serving in the Union Army, and finally the causes of its discontinuation as a German newspaper—causes which can be applied to German newspapers in general in Missouri:

> Mit schwerem Herzen, mit trüben Gedanken schreiben wir diese Zeilen. Sie gelten dem Abschied von unseren lieben deutschen Lesern, dem Abschied von der Tätigkeit an einem Werk, dem unsere Grosseltern, Jacob Graf und Christina Graf; später Graf Bros., Theodore Graf und Julius Graf, und dann die Graf Printing Co., ein ganzes Lebensalter gewidmet, an dem sie seit 71 Jahren treu und unermüdlich gearbeitet haben. Kurz, dies ist die letzte Nummer des "Hermanner Volksblatt."
>
> Schon seit Jahren war die Herausgabe des Blattes nur unter grössten Schwierigkeiten und finanziellen Opfern möglich. Seit Beginn dieses Jahrhunderts war ein stetiges Abnehmen des deutschen Leserkreises zu bemerken, verursacht durch das Dahinsterben der älteren Generation und dem Mangel an Interesse, welches von der jüngeren Generation der deutschen Sprache entgegen gebracht wird. Der schwerste Schlag für alle deutsche Zeitungen war die von Propagandisten während des Weltkrieges gegen alles Deutsche in's Leben gerufene Antipathie.[1]

Chapter Three deals with cities and towns in which German newspapers and periodicals were established and published. Cities and towns are arranged in alphabetical order, and the mileage from town to town is given to show how far the German newspapers were published from each other. The newspapers and periodicals are in chronological order except for St. Louis.

Chapter Four gives a chronological list of all German newspapers and periodicals from 1835 up to 1940. All are listed under three headings: Newspapers, Periodicals, and Miscellaneous Publications. Under Newspapers are listed the religious and humorous newspapers; under Periodicals are listed women's magazines and religious periodicals. In the course of the history of some of the newspapers and periodicals names were changed from one German name to another, while other papers took on English names when they were changed into English newspapers. To increase their sale some newspapers were printed in German and English; some had a short existence, their collapse having been brought on through financial failure and competition.

The two most outstanding newspapers during the period of German newspaper history in Missouri were the Anzeiger des Westens and the Westliche Post.

The Anzeiger des Westens, established in 1835, was the first German newspaper printed in Missouri and had an eventful career of 77 years. Being an organ of German freethinkers, it had prominent German men as editors, for example, Henry Börnstein, a Forty-eighter and a lawyer from Munich; Carl Dänzer, the founder of the Westliche Post; and Arthur Olshausen.

The Westliche Post was published for 81 years, from 1857 to 1938, and during those years it was edited by such prominent German men as Dr. F. Wenzell, who helped to publish the first issue of the paper; Dr. Emil Preetorius, editor-in-chief; Carl Schurz, first associate editor, then editor, and also United States Senator from Missouri. Joseph Pulitzer, an Hungarian Jew, who worked his way up from reporter to editor. The Westliche Post began its great career under the leadership of Emil Preetorius and Carl Schurz.

The Herold des Glaubens, which was published from 1851 to 1925, was established by Catholics to counteract the influence of the liberal, freethinking press and orators representing the radical German revolutionists of 1848.

The Lutheraner, which was established in 1844, is still in publication; it is published by the Concordia Publishing House in St. Louis. It was and is the organ of the German Evangelical Synod of Missouri. The archives of the Concordia Publishing House have 75 volumes of the periodical.

The Friedensbote, established in 1849, was the advocate of the Evangelical (Lutheran) Protestants. It is now published by the Eden Publishing House in St. Louis, which has 137 volumes of the periodical.

The only German newspaper, Die Deutsche Wochenschrift,

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published in Missouri at the present was established in 1938 in St. Louis. It is edited by its founder, Eugen Geissler, and managed by his wife, Marie Geissler. It is published every Thursday and costs ten cents per copy.

All German newspapers were against the institution of slavery. The newspapers and periodicals that were established by religious organizations were for the purpose of promoting their respective religion and protecting and seeing after the welfare of their constituents. It was among these publications that were found periodicals still published in 1940. In the history of the papers a struggle for survival was perceived on the part of the papers. In some cases disharmony arose between the editor and owner when the editor assailed the people with little judgment and showed tendencies toward sectionalism. There arose in one case a misunderatanding between editors and publishers which caused the discontinuation of the paper. The humorous papers were pioneers in bringing caricature and criticism to the field of politics and newspaper publication. For most of the newspapers and periodicals the names of editors, owners, and publishers are given. Most of all, the German newspapers kept their readers informed on all phases of activities happening in their native land.

Microfilm $2.00; Xerox $6.60. 138 pages.

1. Hermanner Volksblatt, Jahrgang 71, No. 29, Hermann, Missouri.

Abstract published by special arrangement with The Ohio State University.

AN HISTORICAL STUDY OF THE ST. LOUIS GLOBE-DEMOCRAT, 1852-1958

(L. C. Card No. Mic 59-2625)

Jim Allee Hart, Ph.D.
University of Missouri, 1959

Supervisor: Dr. Frank Luther Mott

The St. Louis Globe-Democrat is now the only morning newspaper in a heavily populated metropolitan erea. For more than a century, its contributions to American journalism have been outstanding. Its editors and publishers have been recognized as community, state, and national leaders and journalists. Their contributions to public service have brought renown to them and their paper.

Founded in 1852 as the Missouri Democrat, the journal until 1879 was mainly a political organ. In a predominantly Southern state, it promoted Free-Soilism, advanced the idea of compensated emancipation, became the chief mouthpiece of the Republican Party, and later fathered the Liberal Republican movement.

After 1875, as the Globe-Democrat, it became a leader in the "new journalism" movement, an exponent of "yellow journalism," and finally a conservative newspaper. Its weak editorial policies led to a decline in its prestige. Now, however, as a member of the Newhouse group of newspapers, it is again becoming a forceful paper.

William McKee, publisher and majority owner, was the leading personality of the Missouri Democrat. Men who helped promote his paper with their political writings were prominent state and national leaders--Thomas H. Benton, Frank Blair, B. Gratz Brown, and Peter L. Foy. McKee employed such nationally known journalists as James Redpath, Henry M. Stanley, John Hume, and William Grosvenor..

In 1872, McKee and Daniel M. Houser, who owned a small share of the Democrat, sold their interests to George W. Fishback, a part owner since 1857. McKee and Houser then started a rival paper, the St. Louis Globe. The Globe was successful, and in 1875 McKee and Houser bought the Democrat and merged the two papers into the Globe-Democrat. McKee's complicity in the Whisky Ring Frauds and his death in 1879 brought a change in editorial policies.

Editor Joseph B. McCullagh was the dominant personality of the Globe-Democrat until his suicide in 1897. Under him, the paper became less a party organ and more a modern newspaper, enlivened by all the characteristics of "new journalism." Through stunts and crusades, the editor created a paper with great reader interest. He can easily be credited with being the greatest contributor to what the New York Times called "the great tradition of St. Louis journalism."

Much of the financial success of the paper during its first fifty years can be credited to the business acumen of Daniel M. Houser, who believed in paying huge sums of money for news-gathering. It was he who advanced the idea of employing telegraph operators as correspondents.

Captain Henry King, editor from 1897 to 1915, coped with the terrific competition of the St. Louis Republic and the Post-Dispatch during the "yellow journalism" period. Under him, the paper broadened and departmentalized its news. At the same time, it exerted a conservative influence in comparison to its muckraking competitors.

The twenties brought "flush times" to the Globe-Democrat. E. Lansing Ray, McKee's grandnephew, gained control of the paper and engineered the absorption of its longtime rival, the Republic. Casper Yost, his editorial page editor, became nationally known for his work with the American Society of Newspaper Editors and for his contributions to develpoing a journalistic code of ethics.

But the paper suffered from the economic depression. A conservative editorial policy, born with the absorption of the Republic, a Democratic paper, and evolved in the depression and World War II, led to a decline in the prestige of the paper.

In 1953, the Globe-Democrat was sold to the Newhouse group of newspapers. Since then, positive editorial and news policies seem to be effective in regaining for the paper its former prestige in the journalistic world.

Microfilm $4.10; Xerox $13.80. 319 pages.

LANGUAGE AND LITERATURE, GENERAL

A STUDY OF COSMOPOLITAN MAGAZINE, 1890-1900: ITS RELATION TO THE LITERATURE OF THE DECADE

(L. C. Card No. Mic 59-2520)

Sister Mary Damascene Brocki, CSSF, Ph.D.
University of Notre Dame, 1959

The study proposes to investigate the literary achievements of Cosmopolitan Magazine for the years 1890 to 1900. It includes a review of the content of the magazine for the period, an examination of the editors' concept of the function of a writer, an interpretation of the magazine's literary standards, an analysis of the degree of application of these standards to the selection of fiction for publication, and, finally, a summary of the literary contributions of the magazine for the decade.

Primary sources used in this study were the twenty volumes of Cosmopolitan Magazine from January, 1890 to April, 1900. The total magazine content for the decade was given attention to determine the organization, purpose, and treatment of issues and problems of the day. Information on the concept and status of the writer in the period was taken from biographical articles, literary essays, and incidental remarks in the book-review department. Standards and values of the magazine, nowhere clearly stated, were adduced from frequent remarks made in regard to literary preferences and prejudices; in this way a definition of the literary principles of the magazine was arrived at. The study of the fiction published in the magazine during the decade was centered on that written by recognized authors, that of frequent contributors, and that which indicated some stylistic or thematic innovations.

The results of this study indicate that Cosmopolitan Magazine for the years 1890 to 1900 was a major example of the magazine revolution of the Nineties. Strong in ideas, individualistic, functioning in many fields, it performed the service of coordinating and interpreting information about literary, social, economic, and political problems for a nationwide audience, and thereby helped to open the minds of readers to cultural and social trends. During a decade deemed "crucial" because of the literary battle between realism and romanticism, Cosmopolitan Magazine gave a full, rich and positive documentation of its fight for realism, to a degree unusual if not unique in a popular periodical. Through its biographical sketches, essays, and reviews, it introduced contemporary realistic writers and their ideals to the American reader. Through its criticism of contemporary fiction Cosmopolitan Magazine made substantial contributions. It gave instances of singular insight in the judgment of individual authors; it did much toward breaking down the prudery of Victorianism and in establishing new standards of criticism and judgment in art; it was instrumental in encouraging the expression of imagination and impulse as seemed artistic and truthful to the writer; it was indefatigable in encouraging the public to accept and to enjoy the best in literature. In its choice of fiction for publication, also, Cosmopolitan Magazine made literary history. By printing stories in which man, his problems, and his thoughts on any subject were revealed, the Cosmopolitan helped to break the confining limits that society and morals had placed on the writer of a previous decade, and thus opened the road for the development of naturalism. By publishing a large array of stories that dealt with the average man and his everyday affairs, it strengthened the foothold of realism. The fiction it published during this decisive decade illustrated and promoted certain significant developments in prose: in style, the inauguration of a crisp, reportorial kind of writing which added zest and vivacity to recorded descriptions of contemporary manner, talk and custom; in technique, greater objectivity in recording scenes and events, originality in introducing new points of view, and greater emphasis on psychological analysis of action. In all of this Cosmopolitan Magazine presented an index of ideas, prejudices, interests, and the spirit of the times. Besides that, in its timely critical analysis of the literary scene, with the added dimension of demonstration in fiction of the relation between literature and contemporary life which was advocated in its criticism, Cosmopolitan Magazine was a significant force in the literary development of the period.

Microfilm $2.75; Xerox $9.40. 209 pages.

THE POLITICAL PAMPHLETS OF EDMUND BURKE

(L. C. Card No. Mic 59-2767)

Paul Joseph Edmunds, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Ricardo B. Quintana

The ascent of George III in 1760 threatened to destroy the balance of governmental powers which had been created by the Glorious Revolution of 1688. The patronage of the crown was used to corrupt the legislative and the judicial branches of government, and the result was an executive branch of the government whose tyranny threatened to restore absolute monarchy in England. The Whigs split into many small factions. Their union into a strongly centralized political organ would have made possible a means to thwart the king's ambition. One group alone, the followers of Rockingham, presented a persistent opposition to the encroachments of the king. Under Rockingham, Burke, a young man of 36, undertook the program of awakening the other factions to the great principles of the Revolution of 1688. His Parliamentary career began after he had received international acclaim for his literary talents in The Vindication of Natural Society and An Inquiry into the Relationship between the Sublime and the Beautiful.

To accomplish the solidification of the Whig party, he

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relied upon the pamphlet, a literary form peculiar to his age. Defoe, Swift, Steele, Addison, Walpole, and Bolingbroke, among others, had already made the pamphlet a permanent literary device. By 1782, Burke's political pamphlets and his strenuous endeavors in Parliament to check the growth of the king's powers had succeeded in forcing George to acknowledge the legislative supremacy of Parliament. North, the king's favorite, was succeeded by Rockingham, whose untimely death prevented the execution of the reforms which the Rockinghamites had demanded. His successor, Pitt, popular with the people and acceptable to the king, succeeded in restricting the growth of the crown's powers.

Another of Burke's problems was the growth of the British empire. His Herculean endeavors to force England to compromise with the colonies failed, and England lost thirteen of her most valuable possessions. His close associations with India through his brother, Richard, and a very intimate associate, William Burke, had made him realize the abuse of power on the part of the East India Company and of Warren Hastings, the Company's agent. To prevent the recurrence of Parliamentary indifference to colonial management, Burke undertook a thorough investigation of the handling of that vast empire. The results brought about the trial of Hastings, a trial which Kronenberger has called "a kind of valedictory of the old order." Although the former Governor-General was acquitted, Burke had succeeded in arousing public indignation against the tyranny of Hastings.

Indignation against the horror and outrages of the French Revolution prompted him to sound a warning to civilization against Jacobinism. His Reflections on the French Revolution, the most explicit statement of his political beliefs, gave him a prominence he had never known. For the last eight years of his life his pamphlets continued to echo his Cassandra-like prophecies of doom and of warning against Jacobinism. England responded to his warnings with a vigorous war effort. Burke argued that victory could be assured by the emancipation of Ireland and of the Catholics. Although he had continuously advocated Irish and Catholic emancipation as a basic principle of the Whig party, the Pro-Irish and the pro-Catholic pamphlets of the last eight years of his life reflect a dedication more vehement than his earlier efforts to give the Irish and the Catholics political equality. Specific attention is called to Burke's preoccupation with his conviction that the new government in France could be crushed by giving the Irish and the Catholics a political freedom which would be a sufficient incentive for them to help in the defeat of the French menace.

In his defense of the American colonies, in his effort to emancipate the Irish and the Catholics, in his castigation of Hastings's misrule of India, in his opposition to the extremists of the French Revolution, Burke's insistence on the great principles of the Revolution and his unselfish dedication to the freedom and supremacy of Parliament helped to revitalize English politics.

Microfilm $4.70; Xerox $15.80. 367 pages.

THE INFLUENCE OF DON QUIXOTE ON MODERN CHIVALRY

(L. C. Card No. Mic 59-1757)

John R. Hendrickson, Ph.D.
The Florida State University, 1959

Although Modern Chivalry remains comparatively untouched by the critics, existing evidence indicates that Brackenridge was influenced by Cervantes. The purpose of this study is to illustrate how and to what extent Modern Chivalry was inspired by Don Quixote. Because Modern Chivalry and Brackenridge are relatively unknown, Chapter I furnishes a biographical sketch of the author and a brief historical and critical analysis of his masterwork. Modern Chivalry is discussed in the light of Brackenridge's other writing and in relationship to the novels of the author's American contemporaries. Subject matter and technique, Brackenridge's innovations, and the question of his influence on other writers are taken under consideration. Opinions derived from the analysis of the novel are weighed against existing criticism in an attempt to evaluate the intrinsic worth and historical importance of Modern Chivalry. Chapter II makes the transition from the background material to the main problem of the study. Brackenridge's reading of Don Quixote is discussed, and commentaries on the influence of Don Quixote on Modern Chivalry are examined to show what has been done with this problem to date. Chapter III treats the more obvious similarities between Modern Chivalry and Don Quixote. Brackenridge's use of Cervantes' plan is discussed; Captain Farrago is compared with Don Quixote; Teague O'Regan is compared with Sancho Panza; and corresponding incidents and passages are presented to demonstrate that Brackenridge relied heavily upon Don Quixote for his plan, character portrayals, and situations. Chapter IV deals with the more subtle likenesses as well as the implications of the similarities. The strong correspondence in the authors' attitudes toward ignorance, dishonesty, mediocrity, and incompetence is examined. The similarity in their treatment of the ideal-real (literature-life) complex is discussed, and the striking resemblance between their educational theories is illustrated. Not only does the examination of the many similarities between the two works clearly show that Brackenridge was a conscious imitator of Cervantes but also that the purpose of Modern Chivalry is fundamentally the same as that of Don Quixote. Stated briefly, it is to awaken mankind to the realization that the difference between what is and what ought to be can be resolved by educating the ignorant. The strength of Brackenridge's work is that under the influence of Cervantes he produced a novel of eminent good sense appropriate to the America of his own day.

Microfilm $2.00; Xerox $6.40. 134 pages.

HAMLET FROM EDWIN BOOTH TO LAURENCE OLIVIER: SOME CHANGING INTERPRETATIONS REFLECTING CHANGES IN CULTURE AND IN THE TASTES OF AUDIENCES

(L. C. Card No. Mic 59-2584)

Daniel Ronald Kroll, Ph.D.
Columbia University, 1959

Following an approach used in many college humanities courses, this study is an investigation of the manner in which an actor of the role of Hamlet reflects in his interpretation of various aspects of the culture of which he is a part—social, scientific, technological. An actor's performance is a good index to a culture because the actor achieves self-expression only in the immediacy of a sympathetic audience.

As a background for an analysis of eminent Hamlet performances since the mid-nineteenth century, we need acquaint ourselves in a general way with the audiences and theatrical conditions affecting the performances of the following English actors: Richard Burbage, Thomas Betterton, David Garrick, John Philip Kemble, Edmund Kean, William Charles Macready, Samuel Phelps, and Charles Kean. In America, the audiences and theatrical conditions affecting the performances of Lewis Hallam, Jr., and Edwin Forrest also comprise a useful background.

Beginning with Edwin Booth, the great American Hamlet, there is available a plenitude of materials for study—journalistic reviews, promptbooks, memoirs, and playbills. The most important social change during Booth's era was the rapidly improving economic and social status of the common man. The American people were acquiring a self-conscious interest in art, and Edwin Booth became an important symbol of refined taste. An indication of the moral fastidiousness of his audience is to be found in the expurgations in Booth's Hamlet promptbooks and in an impersonation which conformed with the ideals of the "genteel tradition" and the "age of innocence." Booth's dominant position over his theatrical associates and his disproportionate share of the box office receipts are indicative of the rugged individualism which his era extolled. The resplendent Booth Theatre (1864-65) catered to the sensate taste of the gilded age.

In England, Henry Irving's interpretation of Hamlet reflected cultural elements similar to those manifested in Booth's interpretation. Attendance at Irving's Lyceum became a fashionable custom for successful businessmen, professional workers, and government workers. Irving's emphasis on ritual appealed to an audience which had a high regard for aristocratic traditions. The introduction of limelight, and later of electricity, fostered the more "natural" kind of acting with which Irving was credited. During the later part of the nineteenth century, there was a foreshadowing of several changes in Hamlet production: (1) critics like George Bernard Shaw were advocating a playwright's theater; (2) William Poel was advocating the presentation of plays in accordance with Elizabethan theatrical conventions; (3) Gordon Craig and Adolphe Appia were turning away from the pictorial stage. Nevertheless, the Victorian tradition prevailed until World War I, chiefly in the Hamlet of Herbert Beerbohm Tree and Johnston Forbes-Robertson.

The disillusionment following World War I, the independence enjoyed by women, the psychology of Freud, the acceleration of technological progress, and the extension of educational opportunities for the common man were reflected in the Hamlets of John Barrymore, John Gielgud, Maurice Evans, and Laurence Olivier. The theories of Gordon Craig found successful expression in the Hamlet settings of Robert Edmond Jones and Jo Mielziner; William Poel's experiments found successful application in Evans' unabridged Hamlet. It was with Maurice Evans' "G.I." production and with Olivier's "talking" film that Hamlet became theater fare for a mass audience. In order to gain wide appeal for their Hamlets, Evans and Olivier emphasized the melodramatic aspects of Hamlet and avoided a subtle analysis of Hamlet's character. Since World War I, the democratic influence has been apparent among actors as well as among the members of the audience, for there has been an increasing emphasis on the total production--on the ensemble effect--and less emphasis on the star.

The wide disparity between the Hamlets of Laurence Olivier and Edwin Booth is indicative of the extensive cultural changes which have occurred between the Civil War and World War II.

Microfilm $3.50; Xerox $11.80. 269 pages.

AN EDITION OF ANTHONY MUNDAY'S JOHN À KENT AND JOHN À COMBER

(L. C. Card No. Mic 59-2049)

Arthur Emmet Pennell, Ph.D.
University of Illinois, 1959

The present edition of John à Kent and John à Cumber examines the play for its "prompt-book" characteristics and its structure. Early in the 19th century the unique manuscript of the play was found among the Mostyn family papers. Since the subject matter of John à Kent seems indirectly related to the Mostyn family history, it is possible that Munday derived his source material from the library at Mostyn Hall. The play was first edited by J. P. Collier in 1851; Farmer made a facsimile in 1912. In 1923 Miss St. Clare Byrne edited the Malone Society reprint and in 1930 J. W. Ashton in a doctoral dissertation examined some historical and folklore elements in the play.

The unique manuscript (now at the Huntington Library) written by Munday on handmade paper originally consisted of seven sheets; folio 13 is now fragmentary, representing a loss of about 35 lines. Munday used two or three inks. His hand and spelling are regular, as is his habit of using a colon after a penultimate line of speech.

That John à Kent is some form of "prompt-book" is shown by the "Book" in its title and by seven prompt additions, four in a hand resembling that of the reviser of Sir Thomas More and the scribe of Thomas of Woodstock. Estimates are inconclusive but certainly two and possibly three hands other than Munday's made the prompt entries. All directions are rather complete. Revisions are in the form of deletions and seventeen marginal crosses. The crosses may indicate anticipatory reminders for music or entrances and deletions of expendable speeches.

The structure is most significant for its use of the dance which creates a symmetrical pattern of reciprocating action; pendant scenes show parallels in virtually every

detail of entrances, exits, and frequently even in the number, character, and form of lines given to characters. Entrances and exits often display parallel rhythmic patterns (IV.i.777ff. and IV.ii.1224ff.; IV.i.1149ff. and IV.ii.1294ff.). Other strong dance elements suggest the further possibility that Munday derived the play from an elaborate song dialogue: the asides (similar to those of the song Roland Genandt, printed 1599); the attempt at natural dialogue; the short alternating speeches; the lamenting lover and his encouraging friend whose dialogue begins the play; the relationship of Shrimp, Kent's assistant, to Robin Goodfellow; the fish names of the clowns; and the topsy-turvy lines. All these elements contribute a singular hybrid quality to the structure. No plays of the same type or others by Munday are so permeated with the dance motif.

The date at the end of the play has been reasonably established as 1590 by means of a photographic enlargement. Its composition may be dated between 1587 and 1589. The evidence is speculative, depending upon the possibility that the apprentices Robert Goffe and William Eccleston were cast by Munday. There is no extant stage history except for the indirect possibility that the popular Wise Man of Westchester is an adaptation of John a Kent.

To preserve the "prompt-book" character of the manuscript the text was virtually transcribed, preserving spelling, punctuation, and position of directions and prompt additions of the original. Its variant readings are based upon collations of the Collier edition, the Farmer facsimile, a microfilm, and the Malone reprint. Critical apparatus includes textual and explanatory notes.

The predominance of disguise puts the play in the class of multidisguise plays and indicates that John a Kent probably started this trend.

Microfilm $3.00; Xerox $10.40. 232 pages.

OLD MEN, YOUNG MEN, AND SLAVES (A STUDY OF SOME STOCK TYPES IN SHAKESPEARE'S COMEDIES)

(L. C. Card No. Mic 59-2869)

Samuel Cabot V. Stetner, Ph.D.
Columbia University, 1959

Titled after the three categories of male masks of comedy in the Onomastikon of Julius Pollux, this dissertation analyzes the manner in which Shakespeare treats stock characters and situations in his comedies. The first part of this study traces the familiar figures of comedy beginning with the earliest dramatic sources. Among the works examined are the fragments of Epicharmus, the plays of Aristophanes, the mimes of Herondas, and the comedies of Plautus and Terence. Some of those sources, supported by a few non-dramatic ones, such as the Characteres of Theophrastus and the Tractatus Coislinianus, provide fairly complete galleries of stock types. The examination of the seven basic types of the commedia dell'arte, which terminates the first part of this study, rounds out the roster of the traditional characters of comedy with which the characters of Shakespeare can be profitably compared.

The remainder of the dissertation--the major portion--deals almost exclusively with Shakespear's characters. These are categorized in the manner indicated in the title. The Slave category comprises attendants, followers, messengers, clowns, and so forth--most of the personae of relatively inferior social status many of whose congeners in Italian popular comedy are termed zanni. The transition from classical servus to Elizabethan servant represents, for most dramatic purposes, no more than a nominal emancipation.

Wherever it is pertinent or possible to do so, the correspondence between Shakespeare's characters and the traditional types is pointed out. Occasionally Shakespeare delineates a given stock character without modification; more often his delineation is a distinct departure from common practice. In almost every case, however, his treatment is carefully premeditated to achieve maximum theatrical effectiveness.

It is, of course, a commonplace of scholarship that the comedies of Shakespeare have a brilliance and vitality that is often startling notwithstanding his frequent use of traditional material. An attempt is made in this study to explain precisely how that vitality is achieved.

Microfilm $4.50; Xerox $15.00. 349 pages.

A STUDY OF THE BODLEY MS. 415: ROBERT MANNYNG OF BRUNNE'S HANDLYNG SYNNE

(L. C. Card No. Mic 59-2828)

Idelle DePere Sullens, Ph.D.
Stanford University, 1959

The present study of Robert Mannyng of Brunne's poem Handlyng Synne, falls into two major parts. The first is an essay reviewing the life and times of the author and the tradition of religious literature to which the poem belongs. In the second part, a full transcription of a hitherto unpublished manuscript (Bodley MS. 415) is provided. As a whole, this dissertation is intended to provide the groundwork for a new, critical edition of Handlyng Synne.

Handlyng Synne has been considered one of the major monuments in Middle English literature since the publication of F. J. Furnivall's edition for the Roxburghe Club in 1862. Furnivall employed Harley MS. 1701 as a basic text for his edition, with variants from Bodley MS. 415. When he re-edited the poem for the Early English Text Society (1901, 1903), Furnivall added variants from the fragmentary Dulwich MS. XXIV.

The present writer believes that the Harley MS. may be a direct copy from the Bodley MS., and that the latter presents a much more complete and accurate text of the poem. Part of the evidence for this position is deduced from comparative passages in the complete text of Handlyng Synne found in Folger MS. 420312, a manuscript that bears close resemblances to the version in the Bodley MS. The relationship of the three complete manuscripts is discussed and a summary is provided of the character of fragments found in Ashmole MS. 61, Cambridge University Library MS. Ii.4.9., the Vernon and Simeon collections, approximately fifty lines from the lost "Bowes Midland" MS. which are preserved in Halliwell-Phillips' Dictionary of Archaic Words . . . from the Fourteenth Century (1847), and the Dulwich MS. XXIV.

On the basis of the tales included in the poem, an attempt is made to trace the tradition of literary materials which might have been employed by Mannyng to alter and augment the Anglo-Norman Manuel des Péchés which he used as a source. The nature of Mannyng's alterations suggest that he may have used a sermon handbook similar to the Speculum Laicorum in choosing additional or alternative tales as illustration of the doctrine.

Appendices include the following supplementary material: (A) list of extant manuscripts of Handlyng Synne and the Manuel des Péchés; (B) tabular analysis of the tales included in both poems, together with information concerning probable sources and analogues in earlier and contemporary writings; (C) a study of the tales contained in various manuscripts of the North-English Homily Collection and their relationship to tales in the Manuel des Péchés and Handlyng Synne.

Microfilm $4.45; Xerox $15.20. 354 pages.

LANGUAGE AND LITERATURE, CLASSICAL

RECENT CRITICAL WORK IN THE FRAGMENTS OF EURIPIDES

(L. C. Card No. Mic 59-2709)

Eugene Waldo Bushala, Ph.D
The Ohio State University, 1954

The dissertation presents a substantial beginning which I have made in the compilation of an Index Verborum in Euripidis Fragmenta, a work planned in conjunction with Drs. Kenneth Abbott and William R. Jones, of the department of Classical Languages at the Ohio State University, who are compiling an Index Verborum of the extant plays of Euripides.

An index verborum lists every occurrence of each word of the works of a given author. The listings are taken from a basic text which has been well edited and of a recent date. Before the Index could be begun, an additamentum ad apparatum criticum, which is an addition to the apparatus criticus of the basic text, was necessary for the compilation of the Index, and it was this project which I set for myself in the dissertation.

For most of the fragments, the basic text is that of A. Nauck.[1] Of the many fragments recently acquired from papyri and palimpsests, there was no single text which I might have taken as a basic text. I therefore had to choose one for each of these fragments. Another difficulty was encountered in assigning these newly discovered fragments to the plays to which they belonged. I chose the texts on the basis of the competency of the editor and the completeness of the apparatus criticus, at the same time trying to secure one which had been recently published.

The additamentum consists of emendations made upon these basic texts since their publication. The following is an entry taken from the text of the dissertation showing emendations on verse 6 of fragment 327:

Fr. 327, 6: καὶ ⟨τοὺς⟩ θεοῖσι μικρὰ θύοντας τέλη

θεοῖς τε μικρᾷ χειρὶ θύοντας τέλη coni. Papageorgiu apud Wecklein, 1896, 124.

καὶ θεοῖσι μικρᾷ χειρὶ θύοντας τέλη

coni. Wecklein, ibid.

καὶ θεοῖσι μικρὰ χἰρὰ κτλ.

legendum put. Walker, 1920, 14.

The emendations are followed by the year in which they were published and the page number of the periodical or book in which they appeared. Consultation of the bibliography will give the name of the article and the journal or the book. For example, Papageorgiu's conjecture, which I was unable to find, was cited by Wecklein on page 124 in his article "Bericht über die die griechischen Tragiker betreffende Literatur der Jahre 1892–1895," in the periodical Jahresbericht über die Fortschritte der klassischen Altertumswissenschaft, 88, 1896. Wecklein then emended the line himself. Walker offered another conjecture on page 20 of his book Euripidean Fragments, published in 1920.

I have examined all of the papyrus fragments which have been ascribed to the plays of Euripides and have gathered an appreciable amount of critical material on these fragments. I have also investigated the principal critical work on the traditional fragments published between 1889 and around 1915, together with a considerable amount published after that period. In the preparation, then, of the major part of the additamentum, I have set up, sufficiently for the demands of the project, a system of approach to the subsequent compilation of the Index Verborum in Euripidis Fragmenta.

Microfilm $3.45; Xerox $11.80. 267 pages.

1. Nauck, A. Tragicorum Graecorum Fragmenta. Leipzig: B. G. Teubner, 1889.

Abstract published by special arrangement with The Ohio State University.

JUVENAL AND MARTIAL

(L. C. Card No. Mic 59-2576)

Robert Edward Colton, Ph.D.
Columbia University, 1959

Juvenal the satirist borrowed material from Martial the epigrammatist. Sometimes Juvenal left unaltered the borrowed material, sometimes he gave it a different meaning, sometimes he added to it, sometimes he condensed it. Most often, however, he changed it almost completely.

The books of epigrams most frequently used by Juvenal were Martial III, V, VI, IX, X, XII; next came Martial I, II, IV, XI, XIII, XIV; used least frequently were Martial de Spectaculis, VII, VIII.

It is clear that, before Juvenal began to publish his satires, he had familiarized himself with the whole of Martial's work. Especially in the early period of his literary production, Juvenal found Martial a very fertile source.

Juvenal borrowed material from Martial most extensively in Satires I through VII. In these pieces he raged against vice, women, and the emperor Domitian; there he complained most bitterly about the troubles of poor men, clients, and literary and professional men. For all his attacks (except that directed at Domitian) and his complaints, the satirist discovered in Martial's epigrams a rich mine of material.

Juvenal's later satires are less bitter, and may almost be called moral epistles. After Satire VII Juvenal depended less on Martial's epigrams; indeed, in only one of the later pieces (Satire XI) did he make really extensive use of the epigrams.

Juvenal seldom copied Martial's words and phrases without any change of meaning, thought, or context. Usually, while clearly using Martial as a model, he studiously avoided the epigrammatist's phraseology, but occasionally he was forced to leave unaltered certain proper names and words for which no suitable substitute was available.

Although Juvenal and Martial were friends, they had few acquaintances in common, often had different social attitudes, and moved for the most part in different circles.

Microfilm $4.05; Xerox $13.60. 315 pages.

LANGUAGE AND LITERATURE, LINGUISTICS

WORDS OF CHINESE, JAPANESE, AND KOREAN ORIGIN IN THE ROMANCE LANGUAGES

(L. C. Card No. Mic 59-2822)

Edgar Colby Knowlton, Jr., Ph.D.
Stanford University, 1959

This dissertation is a study of words which have entered the Romance languages from Chinese, Japanese, and Korean. There has been little previous treatment of words of Korean origin in the Romance languages, and the work done on words of Chinese or of Japanese origin is scattered and not always readily accessible.

Preliminary chapters deal with the problem of the definition of a loan word, the possible earliest Far Eastern words in Indo-European, previous work in this field of language study, a survey of the chronology, a classification of the loan words by categories, and a sketch of the use of Far Eastern loan words by men of letters writing in a Romance language.

Sebastião R. Delgado's Glossário Luso-Asiático, published in two volumes in Coimbra in 1919 and in 1921, is the only comprehensive, detailed work which considers exoticisms from Chinese and Japanese in the Romance languages and was the starting-point for this study. Dalgado's work includes exoticisms from African and Asian languages and serves as a glossary of exoticisms for Portuguese. He not only gives extensive documentation from works of Portuguese writers, but also establishes spellings for these words, even if the citations for the words did not always provide examples of his spelling. He placed special emphasis on sixteenth-century Portuguese writers because of his desire to indicate the importance of Portugal in the transmission of Far Eastern words to Europe. Although Dalgado was able to rely on dictionaries and on the advice of the eminent Sinologist, Paul Pelliot, for his identifications of the source of these words, he had no first-hand knowledge of Chinese or Japanese. The indications of etyma are not always sufficiently specific.

Dalgado's glossary and standard etymological dictionaries of the Romance languages were examined carefully for instances of words from Chinese or Japanese; words from Korean were not found in these sources. English dictionaries, too, and the Hobson-Jobson of Yule and Burnell, a repertory of Asian loan words, were examined and a card made for each word encountered. This initial collection of cards provided a convenient beginning for the arrangement of data; suggestions of the Far Eastern etyma were recorded together with date of earliest attested use, Romance spellings, and other information.

Histories of language and other bibliographical aids, besides dictionaries furnished abundant material for enlarging and checking. By a different approach, a variety of literature dealing with the Far East was read and instances of words used by these writers recorded. An effort was made to add to dictionary resources by reading in representative modern writers, chiefly in French and Spanish.

This dissertation contains a set of indexed lists of 298 Chinese, 325 Japanese, and 138 Korean words in the Romance languages. The arrangement is alphabetical by etymon. Indices record all spellings given in quotations or citations from other sources, so that the reader may find (by reference to the etymon) a treatment of any specific Far Eastern word included, together with its Romance language reflexes, or discover to what Far Eastern source a given exoticism may be referred.

Care was taken to make clear the Far Eastern etyma. References are to a definite character or entry in a standard dictionary. Systems followed for transcription of Far Eastern words were the Wade-Giles for Chinese, the Hepburn for Japanese, and the McCune-Reischauer for Korean. Discussions of special problems, references, and examples are given for each etymon.

A separate chapter contains the discussion of Korean loans, the treatment of which is new. A bibliography concludes the dissertation.

Microfilm $11.40; Xerox $40.80. 904 pages.

LANGUAGE AND LITERATURE, MODERN

THE COMPARISON OF POETRY AND PAINTING: WHITMAN'S "OUT OF THE CRADLE ENDLESSLY ROCKING" AND SOME PAINTINGS OF ALBERT PINKHAM RYDER

(L. C. Card No. Mic 59-2932)

Harry L. Carr, Ph.D.
University of Southern California, 1959

Chairman: Professor Holwerda

In this dissertation an attempt is made to compare works of art in two media—Whitman's "Out of the Cradle

Endlessly Rocking" and some paintings of Albert Pinkham Ryder. The purpose of the study is twofold: to demonstrate that such a comparison could be made and to demonstrate that an adequate framework for it may be provided by modern principles of criticism.

The specific method is as follows: (1) Important elements of the works are isolated and analyzed separately. (2) The relationship of these elements to the works as entities is investigated. (3) More or less subjective conclusions are drawn as to the effects on the reader-viewer of the elements within the framework of the entire poem or painting. The effects of the following elements are presented: (a) rhythm, (b) ideas or abstract conceptual elements, (c) structures for affective meaning, (d) "intensities," (e) the "intervention" of the poet and painter, (f) "content," (g) the "qualities" of reminiscence, drama, song, "lament," and "merging." (4) The effect of an individual element within the poem as a whole is compared with the effect of a related element in the painting Elements of literal comparison (lines in the poem that approach literal descriptions of scenes that may be found in the painting) are compared, as well as the purposes of art and the artists' intentions as revealed in the works. (5) The works as entities are then related to the history of painting and poetry, and their relationships to literary-artistic movements are compared—specifically Symbolism, Impressionism, and Expressionism.

The most important "content" in "Out of the Cradle Endlessly Rocking" and in Ryder's paintings is found to be a mystic apprehension of some reality that is within or beyond the appearances of things. Both men were visionaries and were concerned mainly with exact presentations of the results of their journeys into other realms; and, to both men, a work of art was an expression of a felt reality rather than a mere arrangement of sense data. Therefore, their principal goals were to create works in their own way without conforming to preconceived notions of style—they sought to achieve paintings and poems that obey the principle of organic form. In this study it is found that the main parallel between "Out of the Cradle Endlessly Rocking" and Ryder's paintings is the use of organic form.

One of the main conclusions of this dissertation is that there existed an interesting degree of uniformity in the developments in literature and painting in Europe and America during the period under consideration. This uniformity has sometimes been called a "movement," but in this study it is termed a "similarity of attitude-and-method on the part of individual workers in various media." Whitman and Ryder, in similar ways, are found to be related to this important cultural development.

This study consists primarily of a comprehensive investigation of what element-effects of the two media may be compared and an actual comparison of them. A preliminary set of distinctions between the media is also developed, distinctions that would seem indispensable for further scholarship in the field, and it is shown that the method of comparison provides for a rich context of criticism. Problems arise that might not otherwise be encountered, and in this case the solutions to these problems lead to the partial reconciliation of what have appeared to be differing artistic attitudes within a given medium, as in the example of Whitman and the Symbolists.

The method used was found to be workable within the limits of this controlled comparison—there was even evidence of certain invariants in painting and poetry—but the method is still an extension of this writer's thinking and exists only in the form of an analysis and evaluation of these individual works.

Microfilm $2.75; Xerox $9.60. 212 pages.

THE RELATION OF IDEAS AND STRUCTURE IN THE NOVELS OF WILLA CATHER

(L. C. Card No. Mic 59-2765)

William Martin Curtin, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Fredrick J. Hoffman

This study analyzes the novels of Willa Cather in terms of two techniques, point of view and symbolism, in order to discover their relationship to the central theme of each novel.

An analysis of Miss Cather's journalistic comments on literature before she wrote a novel establishes that she was aware of two traditions in the novel. Her reviews show that she saw the ideal position for the novelist as midway between the Jamesian tradition of craftsmanship and psychological point of view and the Naturalist tradition of documentation and objective reporting.

Chapter II. An analysis of Alexander's Bridge and O Pioneers! demonstrates that for all their differences they are both involved with the problem of an individual whose success in life is threatened by a natural decline of energy in middle age. In the second novel Miss Cather tried to rise above the tragedy of life by identifying the future of the heroine with that of the land.

Chapter III. An analysis of The Song of the Lark and My Ántonia demonstrates that both novels are essentially concerned with characters who transcend their natural, individual limitations by identifying themselves with art and children, respectively.

Chapter IV. An analysis of One of Ours, A Lost Lady and The Professor's House demonstrates that all three novels are based on a contrast of contemporary American culture with some other culture (French, pioneer American and Pueblo Indian). The contrast reveals Miss Cather's idea that a completely human life was not possible in a society based on commercial values.

Chapter V. An analysis of My Mortal Enemy, Death Comes for the Archbishop, and Shadows on the Rock reveals that Miss Cather thought of religion as one of the means of transcending the inevitable differences between individuals by giving organic unity to human life.

Chapter VI. An analysis of Lucy Gayheart and Sapphira and the Slave Girl demonstrates that Miss Cather returned to a humanistic view of life, which saw very objectively the need to accept life as it is rather than attempting to transcend it.

The conclusions are two. First, the individualism central to Miss Cather's achievement as an artist was also her most persistent subject. She began her career by accepting standards of individualism that put her sympathetic characters at odds with their environments. Her best work showed a change to a more compassionate attitude toward human beings in general. She sought for a culture which could unite all individuals organically.

Second, her style reflects her desire to stand midway between an internal, individual view of reality and an objective social view. Her theory, the "Novel Démeublé," meant that she accepted the natural object as an adequate symbol of internal feelings. In her best work she symbolized internal character by describing a place to which that character is attached by his deepest feelings.

Microfilm $3.90; Xerox $13.20. 303 pages.

FROM BULWER-LYTTON TO GEORGE ORWELL: THE UTOPIAN NOVEL IN ENGLAND 1870-1950

(L. C. Card No. Mic 59-2841)

Robert DeMaria, Ph.D.
Columbia University, 1959

Since 1870 there has been an unusually large outpouring of utopian novels in England. To understand what this literature is all about one must first organize it, classify it, and clarify the terminology used to describe it. This study will handle the two fundamental problems of classification and thematic analysis.

The term utopian novel can be applied to any novel that involves an imaginary world. An orthodox eutopia is an account of an ideal society after the fashion of More's Utopia or Bacon's New Atlantis. By a physiological or spiritual eutopia I mean one in which an ideal state of being is involved instead of an ideal environment. John Macmillan Brown's Limanora (1903) is a good example. Satirical utopias are designed primarily to make fun of or comment on aspects of the contemporary world. The best known of the modern utopian satires is Aldous Huxley's Brave New World (1932). The term dystopia was coined in an earlier study to describe what can be called a eutopia-in-reverse or an imaginary "bad place." Orwell's Nineteen Eighty-Four (1949) is one of the best known dystopian novels of our time. A final category must be reserved for adventure, romance, or humor. These second cousins to serious utopian literature include science-fiction as well as other fiction designed merely to entertain or amuse. A. Conan Doyle's The Lost World (1912) is typical of such books. Of the eighty four novels described and classified in this study twenty two are orthodox eutopias, fifteen are physiological eutopias, nineteen are satires, nineteen are dystopias, and nine are adventure, romance, or humor.

Utopian novels are essentially novels of ideas. The major themes with which they deal are inevitably closely related to the events and attitudes of the period in which they appear. In the "modern" period (1870-1950) the major events and developments are: the industrial revolution, collectivism, evolution, feminism, and a number of advances in a variety of fields such as atomic science and psychology which we can group together under the heading of "new philosophy," to borrow Donne's phrase. William Morris's News from Nowhere is typical of many orthodox eutopian visions which were a direct reaction to the evils of industrialization and a laissez-faire economy. A standard response to the chaos of brutal competition was the proposal of some form of collectivism, such as those forms described by Blatchford, Morris, Wells, and others. Evolutionary thinking led to visions of new and superior species of man and endless progress. The first "evolutionary" novel in the modern period is Bulwer-Lytton's The Coming Race (1871). The feminist position is supported or attacked in a great number of utopian novels of all types. In most of the ideal societies women are pictured as having achieved complete freedom and equality. But often, as in Besant's The Revolt of Man, the feminist position is ridiculed. In the more recent novels there is often a preoccupation with problems that could not have occurred to earlier writers. Such authors as H. G. Wells, E. M. Forster, George Orwell, Aldous Huxley, and Henry Green deal with some of the developments and ideas which I have labeled "new philosophy."

The number of old-fashioned or orthodox eutopias has steadily declined since the turn of the century, and there has been an increasing pessimism about the future and about the possibility or even the desirability of an orthodox collectivist eutopia. The faith in science and progress has been shaken, and the question of survival has become a preoccupation -- the survival of the whole race of man as well as the survival of the individual personality and spirit.

Microfilm $5.55; Xerox $19.60. 436 pages.

HENRY THEODORE TUCKERMAN AS REVEALED IN HIS PUBLISHED WORKS

(L. C. Card No. Mic 59-2789)

Richard Grant Ellsworth, Ph.D.
University of Maryland, 1959

Supervisor: Dr. Otho T. Beall

Henry Theodore Tuckerman, as revealed in his published works, was, in many ways, a model of the mid-nineteenth century American. In his travel accounts, his historical and biographical scholarship, his social and political attitudes, his artistic and literary criteria, is revealed his sincere allegiance to the Romantic Idealism which dominated his day. This allegiance is shown in his belief in the fundamental goodness and inevitable progress of mankind; in his basic individualism, an almost transcendental egocentrism, which mystically identified the human soul with God, and interpreted self-reliance in terms of intuitional supranatural apprehension; in his dishotomization of his realities, separating the Ideal from the Practical, the intuitive from the reasonable, the commonplace from the beautiful, the here and now from the distant and the past; in his acceptance of Nature as the representation of the Ideal, and of the feminine as the symbol of the Beautiful; in his fealty to emotion and sympathy as the mystical keys to all human relationships; in his strict and didactic morality; and in his professed nationalism and proclamation of divine purpose and destiny in America. Yet, he was conservative in his personal refusal to become involved in reformism, in either outright abolitionism or feminism; in his determined and maintained attitude of Brahmin aloofness from "the herd" and "the multitude"; in his willingness to submit himself to governmental mandate, to support, at least nominally, what was legal and generally accepted; and in his overly-developed and almost unnatural reticence which prevented him from ever achieving that intense ego-exploration imperative within the Romantic philosophy.

His published works reveal him to have been profoundly influenced by three major factors in his private life: his mother's death, his Italian residence, and his deep aversion for the commercial life. Possibly, in his mother's death lie the seeds of his bachelorhood, his need for social (and, especially, feminine) acceptability, his adoration of the ideal woman, and, perhaps, his easy acceptance of the sentimental and the emotional. His Italian travels and residence introduced him to the artistic experience and instilled in him a determination to devote his life to the Beautiful and to the encouragement of its creation and appreciation. And His aversion to the common precepts and standards demanded by American commercialistic enterprise influenced this decision, and shaped his life philosophy in its declaration of an over-stressed materiality in American life, and a consequent under-development of the spiritual and the intellectual.

With the exception of some of his better poems, Tuckerman's travel accounts best reveal his personal attitudes and feelings toward his time and his world.

As a scholar, Tuckerman read widely, but not deeply. His recorded perceptions almost always appear to be reflections of the parallel conclusions of his greater contemporaries. But he considered his theories his own, and, although he often documented a thought or a conclusion, he never admitted to any intellectual debt of spiritual guidance.

Tuckerman's greatest significance is in his constant effort to popularize the Beautiful, and thus, to enrich American life. He sought always to broaden the public perception, to increase American aesthetic appreciation, to combat American preoccupation with commercialism. He was ever the propagandizer for good taste and cultural cultivation. His published works all evidence this. As a recorder of travels, he encouraged an appreciation for European cultural achievement. As a historian and biographer, he was narrative and moralistic. As a literary and art critic, he ever dilligently encouraged the writer and the artist, and always sympathetically explained and interpreted to their audience. As a poet and author in his own right, although he often proved sympathetic with the sentimental demands of his age, he, nevertheless, in spite of such lapses, always strove to broaden the public outlook toward the Beautiful and the Cultural as he perceived them to be.

That his audience appreciated his effort is readily apparent in his evident contemporary popularity. But his death and the end of his social influence, the broad standard and contemporary nature of his appeal, and the swiftly changing public interest, all combined to prove his fame ephemeral, and to banish him to a modern obscurity unworthy of his sincere intent and effort, and obvious contemporary accomplishment. Henry Theodore Tuckerman deserves to be remembered not only for his yet-standard biographical scholarship, and his service as a historian of art and artists in America, but also for his exemplary thought and attitude, the cultured reflections of the literary and artistic standards of mid-nineteenth century America.

Microfilm $3.55; Xerox $12.00. 274 pages.

THE DIDEROT AND BALZAC AFFINITY

(L. C. Card No. Mic 59-2842)

Stephen J. Gendzier, Ph.D.
Columbia University, 1959

Erich Auerbach is one of a distinguished company of critics who have held the view that Balzac was the founder of modern fictional realism in France. Yet this opinion can be qualified by carefully examining the conjecture of other writers, such as André Le Breton and Joachim Merlant, that Diderot was one of the earliest and most influential of Balzac's precursors. The novelist found many of his most cherished ideas in the writings of the encyclopedist, and this fact becomes evident after an examination of the former's novels, articles, and reported conversations.

An analysis of these texts and scattered statements proves, first of all, that Balzac knew most of Diderot's imaginative and theoretical works thoroughly. The evidence clearly indicates, moreover, that before his convertion to Catholicism in 1832, he was warmly inclined toward Diderot the philosopher, the writer, and the aesthetician.

Balzac matured as a craftsman of fiction between 1829 and 1831, and it was precisely during those turbulent, revolutionary years that a new generation of literati turned to Diderot for inspiration. Aware of the intellectual vogues of the period, Balzac sought in them stimulation for his own thoughts on the structure, techniques, and aims of the novel. The re-emergence of Diderot in France as a partial result of the successful publication by both Brière and Paulin of his posthumous works coincided therefore with the artistic development of Balzac.

The novelist was drawn to Diderot in no small measure because of a similarity in temperament. Yet their distinctive personalities were responsible for their different conceptions of the novel. While there were ultimately major ideological and theological divergencies between them, Balzac made frequent use of the encyclopedist whenever it suited his purpose. He borrowed many concrete literary techniques from Diderot, such as the use of certain dramatic and artistic principles in the construction of his novels. Furthermore they had almost identical views on mankind. The human being according to both the realistic visionary and the experimental philosopher was characterized by intense passions, demonic urges, creative powers, animal resemblances, and social interests. This observation was partially caused by the zoological investigations of the eighteenth century. It was a time when the biological aspects of man became a worthy preoccupation of philosophers and men of letters. In the seventeenth century, dramatists and novelists had been almost exclusively concerned with universal portraits of individuals; but during the Age of Enlightenment, the organic nature of man was given increased emphasis. The physiological determinants of the individual as a social animal were treated as seriously as his psychological traits. In literature, this new perspective contributed to the breakdown of the classical ideal and the subsequent flowering of the romantic and realistic movements. It is against this background of ideas that the fictional experiments of our two authors in physiognomy and characterization have been considered.

This study of influence and affinity can not take into full account the complexity and originality of either man. Many parallels in thought may be traced to the climate of opinion and sometimes to the inspiration of other writers. It is

nevertheless true that early in his career, Balzac accepted Diderot as one of those who shaped nineteenth-century thought. This recognition of Balzac lends additional weight to the many correspondences of their ideas and should be considered evidence of filiation. Finally, we can have a better understanding of Balzac by acknowledging his debt to the encyclopedist. In so doing, we have every reason to agree with Larousse, Zola, and other writers who claim Diderot as the true father of realism in French letters.

Microfilm $3.55; Xerox $12.00. 273 pages.

MATILDE SERAO: A STUDY OF HER ESSENTIAL WORKS

(L. C. Card No. Mic 59-2844)

Anthony M. Gisolfi, Ph.D.
Columbia University, 1959

After reviewing the formation of Matilde Serao in post-Bourbon Naples and her earliest sketches, stories and articles (1878-79), this study divides the authentic Serao into the three important themes she pursued in succession and examines the origin and development of each.

The theme with which Serao made her debut as a novelist - the feminine erotic - in Cuore infermo (1881) and Fantasia (1883) is of capital importance in the author's development. It is Serao's effort to portray the world of wealth and "difficult" heroines, the world most removed from the author's small bourgeois life. Writing about this world meant to young, relatively unschooled, Serao what culture and literary baggage represent in the formation of other authors. Thus this first theme is carefully studied from the naive and gauche in Cuore informo to the author's attainment of some measure of artistic consciousness in Fantasia and her memorable pages on the subject of adolescent girls in Part I of that novel.

The theme of the Southern deputy or journalist bent on "the conquest of Rome" is the product of Serao's Roman period (1882-86). This second theme is studied in conjunction with Serao's life and journalistic activity of those years, her consciousness of being an intense Southerner in the indifferent Roman scene. In her two novels on the provincial's assault on the Rome of the eighties she gives artistic expression to the moral climate of the new capital and to the unheroic and egocentric new bourgeois. Her candor in viewing the city and its wouldbe "conquerors" results in memorable pages on Humbert's Rome in Parts I and II of La Conquista di Roma and Chapter III of Riccardo Joanna.

Serao's third theme, the theme of her own Neapolitan world of little people and their tribulations was with her from the beginning, but received her full effort only after the author's return to Naples in 1886. Two basic elements inform the whole series of works that she devoted to her popular and vernacular world: strong attachment and the keenest observation. She uncovered the moral and physical poverty of this world. Her love for it remained constant. This series of works goes from her studies of little children (Piccole anime, 1883) to choral studies of groups of girls ("Telegrafi dello Stato", 1884; "Scuola normale femminile", 1885), to Neapolitan neighborhood scenes of consummate art ("Terno secco", 1887; "O Giovannino o la morte", 1888), to the vast canvas of Naples itself which, together with the belabored thesis of the lottery evil, is the subject of Il Paese di Cuccagna (1890-91).

At the turn of the century Serao returned to the Neapolitan scene with individual studies of humble people defeated by life (La Ballerina, 1899; Suor Giovanna della Croce, 1901; Storia di due anime, 1904). But the freshness and élan of the earlier decade are not there: there is, instead, the set intent to portray the anguish of the humble. Serao's mondo popolare e dialettale grew with her growth to artistic maturity in the eighties and declined with her slow decline after 1890.

The study of the works of Serao's three themes shows that Serao did not really write novels, but series of sketches, portraits and promenades, and beautiful units alternate with inadequate and weary ones. Diffusiveness, abuse of detail, excessive emphasis appear in all of her longer works. As a complement to this estimate of Serao's novels, an analysis is made of the three short stories: "Terno secco", "O Giovannino o la morte", "La Virtù di Checchina" which achieved fuller artistic expression than any of the novels.

Microfilm $2.55; Xerox $9.00. 196 pages.

THE POETIC WORLD OF JORGE CARRERA ANDRADE

(L. C. Card No. Mic 59-1201)

Dorothy Eve Harth, Ph.D.
Syracuse University, 1958

One of the outstanding contemporary poets of Latin America, the Ecuadorian Jorge Carrera Andrade has been praised by critics in this country, Latin America, and Europe. His works have been widely translated. However, no complete analysis of his production exists. The present study attempts to correct this serious omission. It covers the poet's work from his first edition of poems, Estanque inefable in 1922 to the last published edition Familia de la noche in 1953.

The main sources used for this study are limited in number. We have relied on letters from the poet and personal interviews as well as the editions of his poetry and prose works. The essays by Pedro Salinas and Antonio de Undurraga were also useful.

This study begins with a short resume of the state of Spanish, Latin American and Ecuadorian literature in the contemporary period. Then Carrera Andrade has been placed within this framework and an examination has been made to determine what particular currents, if any, molded his poetry.

After a brief summary of the principal events in the poet's life which have bearing on his poetry, the thematic content of his work is studied. We have tried to record the changing interests in the poet's life, and, in addition, trace his love for the small and seemingly insignificant things, both animate and inanimate, which appear throughout his work.

The chapter on Style examines, in particular, Carrera Andrade's use of the metaphor, and tries to show the various ways it is manipulated for effect.

Statistical criteria help determine the degree to which the poet has employed meter, assonance and consonance.

The correlation between the external events of the poet's life and his conformity to fixed poetic forms is shown. We learn that the poet begins as a traditionalist, has a period in which new forms are tried, and returns again to the heptasyllabic, hendecasyllabic and alexandrine lines.

Using his own remarks, we have tried to show in the conclusion that the poet has lived up to his own ideas regarding the role of the artist in society. Carrera Andrade is in touch with his fellow man and the world surrounding him, a world which he continues to "register" in his poetry.

The remarks of some of the poet's contemporaries are presented in the appendix to show that he has gained some measure of fame in his own country and abroad. His future production, if continued on the same high level, should place him in the front ranks of poets of the Spanish language. Microfilm $3.15; Xerox $10.80. 242 pages.

HEINRICH VON KLEIST'S WAY FROM RATIONALISM TO ETHICAL VOLUNTARISM

(L. C. Card No. Mic 59-2819)

Robert Eugene Helbling, Ph.D.
Stanford University, 1959

Kleist's thought is a faithful mirror of the major philosophic developments which characterize the intellectual life of Germany in his time. Rationalism was opposed by various forms of Gefühlskult which in turn were superseded by the Ethical Voluntarism of Kant and Fichte. This study attempts to give a coherent interpretation of Kleist's works and thought in the light of these philosophic trends.

Part I discusses the influence of the German Popularphilosophie and of Kantian and Fichtean philosophy on Kleist's thinking. It is shown to what extent Kant's philosophy refuted the optimistic rationalism of the Popularphilosophie. The possible effects of Kant's several Critiques on Kleist's Weltbild are studied and allowance is made for a quite plausible impression of Fichte's epistemology upon Kleist's mind. The theories concerning Kleist's "Kant-Crisis" are evaluated in the light of Kleist's own statements contained in his letters.

Part II is devoted to an analysis of Kleist's anti-rationalistic revolt. A short transitional chapter shows how his waning faith in a rational and teleological world order gave way to a despairing belief in irrational fate and how he hoped to find a new kind of divine purposiveness in the individual's personal Lebensgefühl. Kleist's own Gefühlskult is then subjected to a comprehensive comparative study. It is illustrated to what extent his activistic concept of Gefühl differs from and accords with Schiller's aesthetic concepts, the panentheistic tendencies of the first Romantic School and the Pantheism of the Sturm und Drang. This study is followed by an interpretation of some of Kleist's major works: Die Familie Schroffenstein, Amphitryon, Penthesilea and Michael Kohlhaas. While the dialectic interplay of Fate, Verstand and Gefühl is depicted, it is also pointed out that Kleist becomes increasingly aware of the epistemological and ethical fallacies in the Romantic Gefühlskult.

Part III considers the affinities of Kleist's essay Ueber Marionettentheater with the secular chiliastic creeds found in both German Classicism and Romanticism. The essay is above all viewed as a symbolic expression of the dialectic unfolding of human consciousness in the historic process from Instinct and Natural Necessity to Freedom and Reason, as described in Kant's and Fichte's philosophies of history and, in a more limited frame, in Schiller's aesthetics. The ideal of Infinite Reason set forth in the essay is also likened to Kant's notion of an "Intellektuelle Anschauung." It is emphasized that the essay has only symbolic value and cannot be used directly as a keystone to the interpretation of Kleist's last drama Der Prinz von Homburg. The final chapter shows that Kleist's quest for the metaphysical dimension in man leads him completely away from Romantic Gefühlskult and toward Kant's ethical voluntarism. The various phases of Kant's moral philosophy are investigated and related to Kleist's own mode of thinking, and Der Prinz von Homburg is finally interpreted in detail in the light of Kant's ethics.

Throughout the dissertation the viewpoint is upheld that the whole of Kleist's works and life can best be understood as a triadic movement of thought from Rationalism via Gefühlskult to Ethical Voluntarism paralleling the prominent intellectual development of his time. In the conclusion, it is made clear, however, that due to a host of tragic external circumstances, Kleist found no rest in his personal life. It is also pointed out that he may have been aware of certain fallacies inherent in Kantian ethics. With its emphasis on moral autonomy, Kant's philosophy puts an infinite distance between man and Being and contains thus the germ of "existential anguish." While Kleist in his Prinz von Homburg manifested a certain belief in the saving grace of the moral law, he seemed to lack such confidence in his personal life and, to conclude from his letters, only regained faith in a Kingdom of Ends or a purposeful universe after having made the fatal decision to take his own life. Microfilm $4.30; Xerox $14.40. 333 pages.

A CRITICAL STUDY OF GRAHAM GREENE

(L. C. Card No. Mic 59-2855)

Francis Leo Kunkel, Ph.D.
Columbia University, 1959

The purpose of this study is to trace Graham Greene's themes, his moral and theological preoccupations, indicating how his characters respond to them.

The travel books and essays best reflect his obsession with evil. In Greene's novels, as in Henry James', the sense of evil is always attached to the idea of betrayal by an intimate. This kind of treachery has so appealed to Greene's imagination that he has made it one of his most persistent themes. His characters, from the earliest, Andrews in The Man Within, to the most recent, Fowler in The Quiet American, repeat the Judas kiss.

By reason of its theme and historical setting, Greene's first novel, The Man Within (1929), is different from any of his other early novels. By the time he wrote It's a Battlefield (1934), he was no longer preoccupied, at least, explicitly, with man's dual nature, the central theme of The Man Within. It's a Battlefield and England Made Me (1935) reflect Greene's concern with the social and economic problems of that day. Communism is put under the novelist's microscope in It's a Battlefield. Capitalism is the slide in England Made Me.

Greene divides his fiction into novels, "entertainments," short stories, and plays. Only the first two categories are likely to cause any confusion. His entertainments can be distinguished from his novels by a greater use of melodrama, by a comparative lack of development in the characters, and by a concession to the happy ending. But in common with the novels, these thrillers, such as The Confidential Agent and The Ministry of Fear, dramatize moral problems of far-reaching significance. In using melodrama for a serious purpose, Greene follows in the tradition of Dickens, Hardy, and Conrad.

Beginning with Brighton Rock (1938), the novels of Greene undergo a radical change. The fundamental difference between the earlier novels, on the one hand, and Brighton Rock, The Power and the Glory (1940), The Heart of the Matter (1948), and The End of the Affair (1951), on the other, is the overt inclusion of Roman Catholic doctrine. Conditioned by their reception of the sacraments, the characters in the Catholic novels illustrate their creator's preoccupation with grace, sin, and the flesh. These themes are presented paradoxically. Those characters who are the recipients of grace, for not all of Greene's characters are, sin more than the non-recipients. The way into the supernatural starts from the depths of sin. The body is corrupt but it also has religious significance. Greene follows St. Thomas Aquinas in considering sins of pride worse than sins of the flesh. If Greene seems too lenient towards fornication and adultery, it is solely as a reaction to the apotheosis of invincible complacency.

By-products of a novelist's career, Greene's plays fall short of his best novels. Better received in New York than its predecessor, The Potting Shed is nonetheless artistically inferior to The Living Room. The Potting Shed leaves unanswered the nature of the all-important relationship between the miracle and Father Callifer's loss of faith: this relationship is so nebulous that no amount of careful reading can pin it down. By comparison with The Potting Shed, whatever faults may be charged to The Living Room are venial.

Microfilm $3.30; Xerox $11.20. 253 pages.

GABRIEL MARCEL, THE DRAMATIST

(L. C. Card No. Mic 59-2856)

Hilda R. Lazaron, Ph.D.
Columbia University, 1959

Although Gabriel Marcel is known chiefly for his philosophical writings which place him as a Catholic Existentialist, he has maintained a separate career as a dramatist. As early as 1911 he began to write for the theater, and his first published play appeared in 1914. Since then, nineteen more plays have come out in print plus the five plays that Marcel classifies as his comic theater. Insisting that they differ from "problem plays" or "thesis plays," the dramatist has called his works "plays of ideas." To be sure, many of them do contain discussions of metaphysics and religion, but even those most heavily weighted with ideas give great importance to character development and the elaboration of psychological relations.

The relatively few writings devoted to Gabriel Marcel as a playwright have endeavored principally to relate the plays to the theories of their philosopher-author. No full study of the drama as such has been written hitherto, despite Marcel's frequent statements that he wished his plays to be treated as a separate entity.

Part I of this study contains two chapters, the first being devoted to the man and the second to an exposition of the important features of the drama, such as the emphasis on death, on music, on spiritual conflicts, and on "the soul in exile."

Part II contains a single long chapter analyzing the plays, which are divided into five groups according to subject-matter, as follows:

1) ideological conflicts
2) conflicts reflecting World War I
3) marital and family tensions
4) conflicts resulting from World War II
5) social conflicts

Part III examines the place of Gabriel Marcel in twentieth-century drama, by relating his plays to those of such dramatists as Giraudoux, Anouilh, Cocteau, Montherlant, Mauriac, Lenormand, Vildrac, Salacrou, Sartre, and Camus--on all of whom Marcel has expressed himself in his regular reviews for Les Nouvelles Littéraires and his longer articles on the theater. The influence of earlier dramatists, such as Ibsen and Curel, on Marcel is also suggested.

The study closes with a Conclusion, an Appendix analyzing the comic theater, and a Bibliography.

Microfilm $3.15; Xerox $10.80. 242 pages.

WILLIAM VAUGHN MOODY — A POET ON THE EVE OF THE AMERICAN POETIC RENAISSANCE

(L. C. Card No. Mic 59-2586)

Hyman Lichtenstein, Ph.D.
Columbia University, 1959

This study of William Vaughn Moody attempts to evaluate him as a poet at a turning point in American poetry. It is intended to answer such questions as: What was his life as a poet like? What areas of experience affected his poetry? In what ways were these experiences meaningful? How did he conceive the role of the poet? What were the underlying themes and concerns of his verse? How did his poetry relate to the older and newer aspects of late nineteenth and early twentieth-century verse? What are the virtues and defects of his verse? Those aspects of Moody's life, personality, work, and times are used which seem pertinent in focusing on the kind of person and poet he was and the kind of poetry he wrote.

The Preface briefly describes the nature of the poetic activity in Moody's lifetime. It indicates that most of the poetry written in the decades preceding the 1912 Renaissance had lost its vitality. Its dominant features were conformity, imitativeness, and timidity. New directions, however, were being found by some poets in the decades following the Civil War. These few poets were pointing to the aims and practices of the Renaissance poets. Their work indicates that the "new" poetry did not spring suddenly full grown. The underlying principles of the varied

poetic and critical activity in the "new" era were reform and experimentation.

Chapter I delineates those blocks of experience which affected Moody or which help shed light on his personality and works. These experiences include: his early years; his years at Harvard; his teaching at the University of Chicago; his residence in New York City after he gave up teaching; his travels abroad; his trips to America's Far West; and his relationship with Harriet Brainard, who for ten years was an integral part of his existence.

Chapter II discusses Moody's concept of the poet and the underlying and unifying themes of his verse. An intense dedication to poetry is found in Moody's life and verse. To Moody, the poet is a dedicated person who, having heard and answered the call, must follow wherever it leads. This commitment imposes upon the poet a responsibility to be a moral and spiritual leader.

What unifies the seemingly disparate themes, subjects, and ideas in Moody's poetry is the passionate belief that life should be lived and measured by the highest esthetic and ethical standards. He hopes such measuring will help bridge the gap between the world's attainments and his rigorous standards. The disjunctions between his ideals and reality move Moody to anger, pity, despair, or doubt; moments of conjunction move him to faith, optimism, or ecstasy. Whether his subject is political leadership, economic or social inequality, love, beauty, art, or the meaning of life, he utilizes his high standards, and is moved by these emotions.

Chapter III analyzes and evaluates Moody's poetic techniques in relation to the practices of his times and to those of the Renaissance. This evaluation contributes to an understanding of his place in poetry. The analysis includes prosody, structure and design, language and diction, imagery, symbolism, and their interrelations.

Although many aspects of Moody's verse foreshadow the "new" poetry, his techniques are more prevalently those of the later nineteenth century. While not content to conform to all that was conventional, he worked well within the bounds of nineteenth-century verse.

Even at his best Moody misses being a poet of the first order. What he had, at his best, was competence, and poetry needs its competent workmen alongside the masters.

Microfilm $2.90; Xerox $10.00. 224 pages.

A STUDY OF JOHN LOTHROP MOTLEY

(L. C. Card No. Mic 59-2823)

Edward Warren Loomis, Ph.D.
Stanford University, 1959

This dissertation undertakes to demonstrate some of the central events of Motley's life, and so it considers not only his literary works but also his involvement in American politics. Motley's brief political ventures variously illustrate his beliefs about history; and the historical writings can forecast the crises of Motley's politics and diplomacy.

Though lacking a settled conviction about the sources of evil in human life, Motley believed very strongly in the fact of evil. He was acute at searching out the event of malice; he demonstrated this power in his histories; but this was a power of sensibility rather than a power of judgment. It was a power somewhat disencumbered in Motley's experience; he had it, but he could not assess it.

Motley had, on the other hand, very strong theoretical convictions about the sources of good. The sources of good which he cherished in a formal, ideological way were republican institutions, and especially the American Republic, science, worldwide commerce, and the progress which steadily marched through them all. These beliefs Motley displayed conspicuously; they worked upon him, and guided him; they were sometimes a rough guide to evil. On occation, Motley could persuade himself that the force opposed to what he took for the good was the insurgent force of evil; and so he could proceed to the attack, following ardent emotion. Inevitably he got into difficulties, for his dichotomies did not always fit his cases. Although he often accomplished an intense clarity, his best clarity sometimes implies a marginal disorder, a confusion not cast in the reckoning. In admiring the revolutionary forces at work in the Netherlands -- his great subject in his histories -- Motley found no way to moderate his admiration; he believed wholeheartedly, and so far as his belief was inadequately qualified, it hurt the histories; but it did not ruin them.

A similar belief in large general matters, such, for example, as the American Republic, and Ulysses S. Grant as a representative American, in his own life did irretrievable harm. Motley believed simply, as it were, and generously; and he should have believed cautiously, and with delicate reluctance. Motley believed in such a way as to harm his judgment: he did not estimate Grant rightly, and sometimes appeared unable to guess any of the motives Grant would be likely to have as President; and so his public career came to wreck on a motive which Grant had very strongly. In Grant's wrath was Motley's downfall; and Motley was surprised when it happened to him.

A flaw in the historical writings; a terrible mishap in the public career: this dissertation proposes a relationship between them, in a common source.

Microfilm $3.15; Xerox $10.80. 241 pages.

A CIRCLE OF MEANING: AMERICAN NOVELISTS FACE THE MILITARY NECESSITY

(L. C. Card No. Mic 59-2254)

John Leslie Marsh, Ph.D.
University of Pennsylvania, 1959

Supervisor: Robert E. Spiller

"A Circle of Meaning" is a study of those American war novels appearing in the time periods 1918-1928 and 1945-1955 whose leading characters are ground combatants in World Wars One and Two. The dissertation's immediate concern is with these fictional characters as they face the military necessity. In respect to this "necessity," two problem areas have been defined: the first dealing with those forces or stimuli which cause the combatant to behave as he does, the second with his acceptance or rejection of the military necessity.

As an indispensable foreground to such a study Stephen Crane's The Red Badge of Courage is first considered in

so much as it represents the first realistic and intuitive study in this country of the effects of combat upon its participants. The fruits of this approach ended by establishing Crane's work as a brilliantly perceptive anticipation of novels to come, providing a means of approaching and evaluating subsequent war novels as studies in human conduct. In The Red Badge of Courage Crane concentrated, as do his successors, upon the individual and his responses in an alien world. He concluded that man as a result of his experiences in combat gives over an immature image of self, achieving the ultimate in manhood.

The novelists of World War One who followed Crane repudiated his acceptance of combat, believing it to be a numbing and soul-destroying experience. Yet what has proven to be the most significant discovery in relation to the novels of the Second World War is their reaffirmation of Crane's view of war as a creative force within the life of the individual. "A Circle of Meaning" then establishes a pattern of acceptance-rejection-acceptance. Crane's Henry Fleming could accept the combat experience as he found it productive of a positive good in youths like himself; the doughboys of World War I rejected Fleming's affirmation, but contesting their denial are the GI's of World War II, who accept the experience, in spite of its desecrations, as a character-confirming and creating force much as Crane did before them.

If there is a "constant" in The Red Badge of Courage and the novels of World Wars One and Two, it is in their repeated testament to certain forces or stimuli that Crane first acknowledged as influencing the man facing combat's demands. In the dissertation these have been designated under such descriptive headings as the brotherhood of battle, a known-unknown dichotomy, and the like. The continued recurrence of these forces in the novels investigated strongly suggests that the combat experience is in essence timeless. Crane first captured its meaning, and later war novelists have done little more than circle him ever since. Microfilm $6.60; Xerox $22.80. 519 pages.

MINES AND MINERS IN FRENCH AND SPANISH LITERATURE OF THE XIX AND XX CENTURIES (A STUDY OF FRENCH AND SPANISH MINERS, THEIR PROBLEMS AND ENVIRONMENT, THEIR HOPES AND ASPIRATIONS AS REFLECTED IN LITERATURE)

(L. C. Card No. Mic 59-2430)

Charles Nicholas Micarelli, Ph.D.
Boston University Graduate School, 1959

Major Professor: José D. Oñate

As indicated in the subtitle, this thesis is a study of miners, their problems and environment, their hopes and aspirations as portrayed in the field of belles lettres rather than in political, economic and social treatises. The task undertaken is a work of interpretation and synthesis. It is a study of French and Spanish literature dealing with mining and the circumstances which inspired it. This study is concerned with the accuracy as well as the artistry of the fictional portrayals. It endeavors to examine the reality of the social and psychological factors which they reveal. Literature divorced from reality creates an incomplete and false situation which Taine calls, "une illusion de bibliothèque".[1]

The descriptions of the physical aspect of mining regions and towns and the portrayal of the toil and suffering of the miners give a more tangible and intimate insight into the reality of existing social problems than would the bare figures of cold statistics. The impressions which we receive in our daily lives are not statistical but pictorial, and the verbal reconstructions presented by the authors studied in this thesis can truly be categorized as plastic. But their artistry goes beyond mere photography. It communicates a true feeling of the tempo of the industrial and social activities in the mining regions.

The French literature which deals with miners from Barbier's "Les mineurs de Newcastle" (1837) to Crémieux's Fosse XV (1955) gives us a detailed picture of the miners' lives in the nineteenth and twentieth centuries. By examining this literature carefully, we can trace the miners' economical situation from complete penury, as best illustrated in Zola's Germinal, to relative abundance as seen in Louis Gerin's Profondeur 1400 and Alphonse Narcisse's L'ombre de la morte. The fight for social justice which occurred in the period between these novels is reflected in the works of Jules Mousseron, Achille Saletzki, Jules Sottiaux, Pierre Hamp, André Still, Paul Eluard and Albert Crémieux.

As in the case of French literature, in Spanish literature one also finds a detailed description of the miner and a thorough analysis of his living conditions. However, there are some differences to be noted. In the French works, we can trace the economic evolution of the miners from complete penury to relative abundance. The Spanish works do not follow this pattern because there has been no marked economic progress in the Spanish mining basins. These works reflect only the misery which has always been the miner's lot in Spain.

The Spanish authors studied in this thesis are Palacio Valdés, Pérez Galdós, Blasco Ibáñez, Concha Espina, Pío Baroja, Isidoro Acevedo and José Maria Morón. Also studied in this thesis are the folkloric mineras, a type of cante jondo which has served for centuries as an emotional catharsis for the miners' tormented souls.

In the past two decades, less literature dealing with mining has been written in Spain than in France. This is probably due to the fact that there is less mining activity in Spain. Literary output is usually in proportion to the importance of a particular activity. Any sincere social work on the miners of Spain would have to reflect their poverty and misery, so it is possible that the scarcity of mining novels may be due also in some part to censorship restrictions.

It is regrettable that we cannot weigh the part which the mining novels played in the betterment of the miners' living conditions in France. There is no way of determining the actual effect of these novels on public opinion and the effect which public opinion may have had on the reforms which were brought about. We can only say that the mining novels, like all other popular social writings, must have influenced to some extent the social cause in France.

Microfilm $3.30; Xerox $11.20. 255 pages.

1. H. Taine, L'histoire de la littérature anglaise (Paris: Hachette et Cie., 1863) p. V.

THE CONTRIBUTIONS OF EVERT A. DUYCKINCK TO THE CULTURAL DEVELOPMENT OF NINETEENTH CENTURY AMERICA

(Publication No. 24,447)

George Edwin Mize, Ph.D.
New York University, 1955

Adviser: Professor Nelson F. Adkins

This study of the nineteenth century editor, Evert A. Duyckinck, traces his editorial activities through a period of some thirty-five years with the purpose of presenting his contributions to the development of American literature.

As associate editor of Arcturus, a journal published from 1840 through 1842, Duyckinck was able to direct its editorial policies into liberal channels. Upholding the professional status of the critic, Arcturus based its criticism on the editor's duty to elevate the taste of the public through descriptive or prescriptive criticism. Duyckinck's liberal editorial policy allowed him to approve of Emerson, though he was not in favor of Transcendentalism. Arcturus also praised the genius of Hawthorne, the translations of Longfellow, and the early poetry of Lowell.

From his work with the American Copyright Club came Duyckinck's interest in supplying the public with books, both foreign and native, that could be sold at a price reasonable enough to attract a large market. His first venture in this field, in collaboration with Bryant, was the short-lived Home Library. This early attempt to establish a library was followed in 1845 by the inauguration of a successful series. Published by Wiley & Putnam under Duyckinck's editorship, the Library of Choice Reading included new and reprinted books by European authors, and the Library of American Books afforded native authors — Poe, Hawthorne, Margaret Fuller, Simms, and Melville — an opportunity to appear in good company. These libraries were a civilizing force in America during the mid-century and attest to the good taste of their editor.

Duyckinck in 1847 became editor and eventually owner of the Literary World, a journal which lasted for seven years. This magazine, enjoying such famous contributors as Melville, Hawthorne, Simms, and Cooke, was conducted with honesty and independence; its criticism was forthright and non-partisan. It was praised by contemporary readers for its accurate coverage of the literary developments both here and abroad; even today it is a notable source of cultural information for its period.

Duyckinck's single most important contribution to the culture of nineteenth century America, however, was the Cyclopaedia of American Literature, published in 1855. Containing informative articles on the principal American authors from colonial times through the mid-nineteenth century, the Cyclopaedia also makes available biographies of and literary excerpts from countless obscure literati. The work thus proved itself of lasting value to the student of American literature; for many of these obscure persons information cannot be found elsewhere. Duyckinck's wide knowledge, his exhaustive search for information, and his acquaintance with his contemporaries are all amply illustrated in the Cyclopaedia.

Possessed of independent means of income, Duyckinck possessed more leisure time than the average editor of the period. To his home on Clinton Place came such friends as Melville, Hawthorne, Simms, Poe, Bryant, Lowell, and Cooke. His large library — containing 18,000 volumes — was generously placed at the disposal of his friends. Much of his time during these years was spent in the role of unofficial literary adviser to such authors as Melville, Gayarré, and Simms. Though in his early life he had sought in vain a university professorship, he later became a teacher-at-large not only to his friends but to countless others who looked to him for guidance in literary and cultural matters.

Duyckinck should be accorded a significant place in American literary history. As one of our first liberal editors, he did much to create an awareness of the importance of European culture in the growing literary life of America; and in various ways he did much to improve the literary taste of his contemporaries.

Microfilm $4.15; Xerox $14.00. 323 pages. Mic 59-3161.

AN EXAMINATION OF THE SOUTHERN MILIEU IN REPRESENTATIVE PLAYS BY SOUTHERN DRAMATISTS, 1923-1956

(L. C. Card No. Mic 59-1763)

William Lee Pryor, Ph.D.
The Florida State University, 1959

Many critics have observed that following the First World War there began a literary renaissance in the South which has not yet been concluded. The novel, the short story, poetry, criticism, and the drama have all flourished; and all have been duly noted and treated as part of this important regional literary movement - with the very notable exception of the drama.

This study is devoted to a critical examination of the Southern milieu in representative plays by Southern dramatists from 1923 through 1956. The former date marks the production year of the first important play which may be said to be a part of the Southern Renaissance, and the latter date is the last possible one to be included at this time. Since the largest portion of the plays written by Southern playwrights during this period have their settings in the South, the milieu of the South serves conveniently as a theme, performing the role of a unifying motif, as well as a key to the greatest number, and, more significantly, to the most important of the plays in the canon of Southern drama.

To insure the significance and importance of the plays to be examined, and to define precisely the area of investigation, the following requirements have been set up: each play shall (1) be full-length; (2) have been performed at least thirty times in a professional production on Broadway; (3) have been published; (4) have its setting principally in the South, ie., one of the original Confederate States; (5) have been written during the period of the Southern Renaissance by an author born in the South. With certain exceptions, which are noted, these criteria have been followed.

In order to place the Southern plays chosen for this study within the larger context of American drama, the beginnings of Southern drama have been briefly traced as a parallel though distinctly individual part of the general awakening of the American theatre which occurred around 1918. However, the primary function of this essay is the

examination of these representative plays in terms of plot, locale, theme, and dramatic structure.

It is shown that the "folk play movement" was an important though rather separate part of the general awakening of the American theatre after the First World War. This movement was given special impetus in the South, and out of it emerged the first significant Southern plays. Moreover, it provided a foundation upon which subsequent playwrights have been able to extend the framework of Southern drama.

An examination of the plays themselves reveals that their settings include the farm, the mountains, the plantation, the city, and the small town, and contribute to an expression of the South as illustrated through physical environment. Equally diverse are the people who populate these dramas; the simple "folk," the aristocracy, the middle-class, and the lower-class are all represented. Here for the first time these people are given honest, realistic treatment in dramatic form. More important, however, is the dramatist's realistic interpretation of the South in terms of its social and economic problems. These are expressed in the plots and themes of the plays.

Evidence, in terms of prizes, awards, and critical esteem, is presented to indicate the importance of this body of plays as dramatic literature. Because of the noteworthy quality of these plays, it seems rightful to acknowledge them as an important part of the larger body of literature which has brought distinction to the South since the First World War and has not only contributed to an expression of this region but has enriched the national literature as well. Microfilm $5.00; Xerox $16.80. 392 pages.

TRANSCENDENCE IN THE POEMS OF HART CRANE

(L. C. Card No. Mic 59-2594)

Vincent Gerard Quinn, Ph.D.
Columbia University, 1959

This study offers a thematic analysis of all the poems of Hart Crane. Its thesis is that the unifying motif in Crane's poetry is the desire for transcendence: that is, the desire to surpass the limitations of time and matter in order to experience the ideal essence of reality. This theme has both a negative aspect in which the poet's dissatisfaction with the ordinary conditions of life is expressed and a positive one in which the fulfillment of his quest is anticipated. In some poems one of these aspects predominates; in others both are present and generate great power by their tension.

The consideration of the culture of Crane's era and his biography enriches the understanding of his central theme. His interest in transcendence was related to several efforts being made during the Twenties to break through the prevailing atmosphere of scientific and cultural materialism. Also by nature and experience he was both disposed to the quest for transcendence and handicapped in fulfilling it.

Crane's early work--the poems published prior to "For the Marriage of Faustus and Helen"--demonstrates his growth in craftsmanship and poetic sensibility. In these poems he expresses the basis of unhappiness from which his thrusts toward transcendence were launched.

His first major poem, "For the Marriage of Faustus and Helen," was a technical and thematic victory whereby he placed a modern poetic idiom in the service of an affirmative, idealistic theme.

The poems written after "For the Marriage of Faustus and Helen" that were included in his first volume, White Buildings, are lyrics expressing the agony and ecstasy of his search for love and spiritual wholeness. Among them are "Possessions," "Lachrymae Christi," and "Voyages," poems generally found obscure yet unmistakably brilliant.

The Bridge is in all respects a major literary achievement. It employs the entire span of American experience as an analogue persuasive to the growth of spiritual consciousness in the individual. It urges a single vision of America's past and anticipates the nation's spiritual fulfillment.

The remainder of Crane's poems--Key West, a volume that he had ready for publication at the time of his death, and twelve poems found posthumously and included in the standard Collected Poems--is characterized by gear and self-pity.

Yvor Winters, Allen Tate, and R. P. Blackmur believe that Crane's concern with transcendence involved him in the errors of self-indulgence and literary obscurantism which they associate with romanticism. However, they fail to recognize the complexity of Crane's artistic experience and are unduly suspicious of nonrational poetic intuition. In contrast, Jacques Maritain in Creative Intuition in Art and Poetry credits the power of the creative experience to penetrate reality to a depth beyong but not incompatible with reason. From this viewpoint, Crane's poetry and career illustrate his success in experiencing the aesthetic transcendence available to the artist but also his defeat in trying to extend his artistry beyond its proper scope. The closest he could come in fusing his creative and personal experience was to make his desire for personal transcendence the central theme of his poetry.

Microfilm $3.60; Xerox $12.20. 280 pages.

NIKOLAUS LENAU'S IMAGERY

(L. C. Card No. Mic 59-2868)

Hugo Schmidt, Ph.D.
Columbia University, 1959

The dissertation abandons the traditional conception of Lenau as a melancholy hussar dashing across the steppes of Hungary. It examines Lenau's works not as a mere manifestation of Weltschmerz, but for their aesthetic value and poetic truth.

An image is defined as the pictorial embodiment of any sense-experience that bears significance going beyond a mere description in the context of a work. Lenau's images are arranged according to the function they serve.

Lenau saw man in two extreme situations: either as a ruthless predator or as an afflicted sufferer. The similarity of images in both of these concepts shows that they are superstructures over the same psychological base. The same two extremes appear in Lenau's concept of love:

he speaks of it either in ecstatically reverent, or in violently sexual images.

Death, the most ubiquitous theme in Lenau's works, has on the one hand a heroic, exuberant aspect, often conveyed in images of an all-consuming Liebestod; on the other hand, death also appears as quiet, resigned extinction. In dealing with the latter aspect, Lenau shows a considerable depth of poetic perception. The images of the mother, of childhood, birds, and water are associated with the idea of death as a benign redeemer.

Lenau's views on nature were conditioned by his attitude toward man. Although he observed the outside world closely and with an express sense for reality, he selected from all objects and elements in nature those which best reflected his own mood. A group of gay nature poems, often artificial in tone, is vastly outnumbered by the melancholy and gloomy. In projecting his own emotions into nature, Lenau often used images of nature animation. Torment and affliction may be conveyed by nature as a whole, but also by its individual components, like water, wind, rocks, ice and snow. Lenau was fond of vast cosmic images--the sky, clouds, thunder and lightning, the sun, the moon, and stars--as a vehicle for his emotions. At times he gave a striking surrealistic quality to these images.

Contrary to the bulk of criticism, it is not Lenau's "bold metaphors" which make him a distinguished poet. His soaring metaphors usually only conceal the unpoetic quality of a given thought or feeling. Lenau was at his best when he was detached from the subject matter of his poems and avoided the febrile, high-pitched style which he unfortunately considered to be highly poetic.

Lenau's nature poems are examined as to their symbolic significance. Using theories by C. G. Jung, F. Strich, and W. Y. Tindall, the author applies the term "symbol" in the sense of a verbal complex that expresses something for which as yet no verbal equivalent exists, and that gives general, eternal validity to what it expresses. The Schilflieder are discussed as non-metaphorical symbols blending nature images with the thought of the lost beloved. In the Waldlieder, a less compact lyric cycle, Lenau introduced the figure of Merlin as a personification of the symbolic unity of nature and man.

Lenau, as a poet and a person, was always torn between conflicting forces. He was never able to take a firm emotional or intellectual stand. In the bulk of his work, he tried to overcome his own instability by a display of false strength. He wrote significant poetry only when he gave utterance to his own true conviction of the transiency of all earthly things.

Microfilm $3.80; Xerox $13.00. 296 pages.

DIDACTIC AND MORAL ELEMENTS IN THE SPANISH PICARESQUE NOVEL

(L. C. Card No. Mic 59-2827)

James Russell Stamm, Ph.D.
Stanford University, 1959

The Spanish picaresque novel may be defined for purposes of tracing the history of literary forms as a genre of prose fiction which had its beginnings in the anonymous Lazarillo de Tormes, its continuation and development in Alemán's Guzmán de Alfarache, Quevedo's Buscón, Espinel's Marcos de Obregón, and El donado hablador of Alcalá Yáñez, and its decadence in the novels of Castillo Solórzano and the biography of Estebanillo González.

The present study concerns itself primarily with the ethical, moralistic, and didactic material which appears in these and some lesser works of the genre, which were published during the century bounded by the years 1550 and 1650. It attempts to show that the use of such material is extensive and that its presence is of significance in the meaning and development of the genre. The moral and ethical evaluations and conclusions expressed in these novels are analyzed in terms of their content and subject matter, and an attempt is made to relate these ideas to the moral and social climate of the period in which the novels were written.

The literary background of the picaresque genre is traced in terms of the traditions and sources which may have played some part in its formation, with reference to possible classical sources in Apuleius and Petroniuw, to possible Arabic sources in the Maqamat of al-Hamadhani and al-Hariri, and to various possible medieval European derivations, such as the fabliaux and numerous folklore traditions.

The position is taken generally that many of the authors of these novels conceived their works as vehicles of moral philosophy or as works of didactic reflection on their experiences, presented in more or less fictionalized form. To support this assumption, material is drawn from the novels themselves in which specific reference to a didactic purpose is made, wherever such a procedure is possible. The content of the novels is then analyzed in terms of the didactic elements which appear, and the elements are grouped in appropriate categories, such as observations on greed, avarice, patience, sexual morality, love, and the pícaro's view of the world and human experience.

In order to place the didactic component which is found in most of these novels in a satisfactory relationship to other literary aspects which are present in them, an analysis of various literary, thematic, and stylistic devices or techniques is given. This analysis included subsections on humor, on the use of horrific tales and anecdotes, on realism, and on various narrative techniques, such as the use of flashback narration, the use of interpolated fables, poetry, novelas, and folklore material, and descriptions of the protagonist's travels.

A brief study of social and economic conditions which prevailed in the period in which these novels were written and attained their initial popularity is given. Examination of some documents of the period, along with the findings of recent scholarship, makes possible an estimate of the fidelity with which these novels reflect the life of the period, and the extent to which the author has distorted reality for literary purposes.

The concluding chapter contains a summary of ethical and didactic material found in the picaresque novels and relates this material, insofar as it is possible to do so, to the social and spiritual currents of the period in which they were written. It is held that the best of the Spanish picaresque novels reflected many aspects of the life of the times and filled a cultural need for a secular reinterpretation of moral and ethical doctrine.

Microfilm $2.85; Xerox $9.80. 218 pages.

HISTORY OF THE COLUMBIA UNIVERSITY LIBRARY, 1876-1926

(L. C. Card No. Mic 59-2859)

Winifred B. Linderman, Ph.D.
Columbia University, 1959

The years from 1876 to 1926 are among the most significant in the long history of Columbia University and its Library, for they cover the period of change from a small undergraduate college with a School of Law and a School of Mines to the complex of a large metropolitan university with graduate and professional schools well established. The acceptance of the concept of instruction by means of a variety of materials and the elevation of research programs to a place of equal importance with teaching required the library to share in the growth of the institution, particularly in respect to resources and services.

The College Library was in existence almost from the founding of King's College in 1754. Like the College, it suffered from the Revolutionary War, but by 1876 it was reported to have a small but valuable collection. At that time it bore the characteristics ascribed to many college libraries of the period: slender resources, part-time administration, inadequate organization, and short hours of opening. In order to provide more adequate service for their students, the Schools of Law and Mines had established their own libraries.

The real history of the College Library starts with the arrival on the Columbia campus in 1876 of Professor John W. Burgess whose insistence on adequate library collections properly cataloged and interpreted for use, together with the establishment, in 1880, of a graduate school with a program of research, gave impetus to a new emphasis on the importance of the library in the educational objectives of the institution.

This study covers the history of the Columbia University Library from 1876 to 1926 and investigates such topics as changes in governmental organization, the growth of resources, services, the related problems of space and centralization versus dispersal of collections, the integration of the library in the Columbia educational program and with resources outside the university, personnel policies, and administrative arrangements.

During the fifty years the leadership passed from a minister-custodian to Melvil Dewey, who established his library school to train assistants for Columbia as well as other libraries and who first organized the unified collections in a new building. George Hall Baker, who succeeded Dewey, laid the foundations for a great research collection; James H. Canfield, former university president, gave the library prestige and an efficient administration; while William Dawson Johnston contributed the bibliographical apparatus necessary for a research program and the concept of service units near potential users. The last twelve years were under the administrations of part-time acting librarians until 1926, when the library school returned to Columbia and Dr. Charles C. Williamson became Director of Libraries and Dean of the School of Library Service.

While the Columbia Library development related was not necessarily unique, the study offers one more partial history of a university library as a contribution to an eventual general history of university libraries in the United States. Microfilm $7.85; Xerox $26.80. 619 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

BESICOVITCH DIMENSION OF LEVEL SETS OF RADEMACHER SERIES

(L. C. Card No. Mic 59-2875)

William A. Beyer, Ph.D.
The Pennsylvania State University, 1959

The problem considered is to calculate the Besicovitch dimension (written dim) of the sets

$$B(c,a_i) = \{x \mid \sum_{i=1}^{\infty} a_i R_i(x) = c; \quad 0 < x \leq 1\}$$

where the a_i are real numbers with $a_i \to 0$, $R_i(x)$ is the ith Rademacher function, and c is a given real number. The dimension will in general depend on the sequence $\{a_i\}$ ($i = 1, 2, \cdots$) and the value of c.

The main results involve (a) non-absolutely convergent series and (b) geometric series.

Under (a) the following result is obtained. If $\{a_i\}$ is a sequence in ℓ_2, but not in ℓ_1, then dim $B(c,a_i) = 1$ for every c.

Under (b) the following results are obtained. It is assumed in each result that $a_i = r^i$ with r a fixed number ($0 < r < 1$) and that $-\sum r^i < c < +\sum r^i$. (1) If $r = 2^{-1/k}$ with k a positive integer, then dim $B(c,r^i) = 1 - \frac{1}{k}$. (2) If $1 > r \geq \frac{\sqrt{5 - \frac{4}{k}} - 1}{2(1 - \frac{1}{k})}$ for a fixed integer $k > 1$, then dim $B(c,r^i) \geq \frac{1}{k}$. (3) If $1 > r > \frac{1}{2}$, then dim $B(c,r^i) \leq 1 - |\log_2 r|$ except for a set C of c's of Lebesgue linear measure zero. This result was suggested by J. R. Kinney. (4) In (3) there are some r for which there are members of the exceptional set C. (5) Let $r = \frac{\sqrt{5} - 1}{2}$. Then $B(c,r^i)$ is countably infinite if there exist n and x such that

$$\sum_{i=1}^{n} r^i - 2c = \sum_{i=1}^{n} a_i R_i(x);$$

otherwise $B(c,r^i)$ has the cardinality of the continuum. (6) If $\frac{1}{2} < r < \frac{\sqrt{5} - 1}{2}$, there exist at least a countable infinity of c's such that $B(c,r^i)$ is one point.

Some of the results on geometric series are extended to more general absolutely convergent series.

The principal method of proof involves a division of the series $\sum_{i=1}^{\infty} a_i R_i(x)$ into n subseries $\sum_{i=0}^{\infty} a_{ni+j} R_{ni+j}(x)$ ($j = 1, 2, \cdots, n$) and a mapping of the unit segment (0,1] into an n-dimensional unit cube by means of the function $T_n(x) = (T_n^1(x), T_n^2(x), \cdots, T_n^n(x))$ where

$$T_n^j(x) = \sum_{i=0}^{\infty} \epsilon_{ni+j}(x) \left(\frac{1}{2}\right)^{i+1} \quad (j = 1, 2, \cdots, n)$$

with ϵ_{ni+j} as the $(ni+j)^{th}$ digit of the non-terminating binary expansion of x in (0,1]. $T_n(x)$ satisfies the relation n dim A = dim $T_n(A)$ for every subset A of (0,1].

The following simple theorem is also used extensively. If a real series $\sum a_i$ has the property that $0 \leq a_i \leq \sum_{j>i} a_j$ for every i, then for every real c with $0 \leq c \leq \sum a_i$, there exists a subseries $\sum' a_i$ of $\sum a_i$ such that $c = \sum' a_i$.

Microfilm $2.00; Xerox $5.00. 96 pages.

ALGORITHMS FOR THE HAND-COMPUTATION SOLUTION OF THE TRANSHIPMENT PROBLEM AND MAXIMUM FLOW IN A RESTRICTED NETWORK

(L. C. Card No. Mic 59-2731)

Edward A. Brown, Ph.D.
The Ohio State University, 1959

The transhipment problem concerns minimum cost shipment of "goods" through a network consisting of nodes and arcs connecting certain pairs of the nodes. An input quantity is specified for each node which acts as a source of supply of the goods, and an output quantity is specified for each node at which there is a requirement for the goods. Two values are given for each arc of the network; namely, the cost of shipping a unit of the goods along the arc and the capacity which places an upper bound on the shipping or flow in the arc. A solution of the problem consists in finding a value of the flow in each arc of the network so that the total shipment of the given quantities is made at a minimum of cost. The problems usually referred to as the "transportation problem" and "assignment problem" are special cases of the transhipment problem.

The maximum flow problem concerns the determination of a maximum flow in a restricted network, regardless of cost considerations. Although it is a problem of interest in itself, it is included in the present work because it arises at each stage of the procedure for the solution of the transhipment problem.

In this work algorithms are developed for solving the transhipment and maximum flow problems. The procedures can be programmed for machine computation; however, the algorithms have been developed in a form which is suitable for hand-computation by assistants or clerks.

The maximum flow algorithm consists of a set-labeling procedure which systemmatically discovers paths through the network along which partial flows may be initiated. The set-labeling procedure is repeated until the network is saturated, that is, until no more flow paths can be discovered. When this occurs, a maximum flow has been achieved.

The transhipment algorithm is an iterative primal-dual procedure which uses the flow-algorithm as a sub-routine. A cycle of the solution procedure consists in examining the matrix of shipping costs to find the cheapest cost paths

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through the network at that stage of solution. A partial network consisting only of the cheapest cost paths is described and the flow algorithm is used to maximize the flow in the partial network. At termination of the flow sub-routine, instructions are given for finding the next cheapest cost paths to start the next cycle. This procedure is repeated until a maximum and optimal flow has been achieved for the complete network, at which stage the overall shipment has been made at a minimum of cost.

Microfilm $2.00; Xerox $6.20. 126 pages.

A PROBLEM IN THE THEORY OF DISTRIBUTIONS

(L. C. Card No. Mic 59-2553)

Thomas Henry Crowley, Ph.D.
The Ohio State University, 1954

One of the most troublesome questions which arises in many aspects of theoretical physics is that of finding a satisfactory mathematical technique for handling singularities in the mathematical model of a physical system. Many techniques have been used, the best known example being the "delta function" which is usually defined by the relations

$$\delta(x) = 0 \text{ for } x \neq 0, \quad \int_{-\infty}^{\infty} \delta(x)dx = 1$$

where it is erroneously implied that the integral is an ordinary Riemann or Lebesgue integral. The theory of distributions has been developed by L. Schwartz[1,2] in order to rigorize the use of such relations as well as many other similar techniques.

The following notation is used:

D — class of all complex-valued functions possessing derivatives of all orders at every point of the real line.

D_I — class functions in D which vanish outside the closed interval I.

D_0 — class of functions in D which vanish outside some closed interval.

Schwartz gives the following definitions:

1. Definition: A continuous linear functional Δ (hereafter designated c.l.f.) on the interval I is a complex-valued functional defined over D_I such that

1) If k_1, k_2 are any complex numbers and $f_1(x)$, $f_2(x) \in D_I$ then $\Delta(k_1 f_1 + k_2 f_2) = k_1 \Delta(f_1) + k_2 \Delta(f_2)$.

2) If $\{f_j(x)\}_{j=1}^{\infty}$ is a sequence of functions such that

a) $f_j(x) \in D_I \quad j = 1, 2, \ldots.$

b) $\{f_j^{(n)}(x)\}_{j=1}^{\infty}$ converges uniformly to 0 on I $n = 0, 1, 2, \ldots$

then $\Delta(f_j) \xrightarrow[j \to \infty]{} 0$.

2. Definition: A distribution Δ on the open set Ω is a complex-valued functional defined over D_0 such that for any closed interval $I \subset \Omega$, Δ defines a c.l.f. over D_I.

Schwartz develops a calculus for these functionals and after obtaining some basic theorems shows how the theory may be applied in a wide variety of problems. A technique often used to solve various types of problems is the employment of a transformation of the coordinate system; consequently, it is of interest to investigate the behavior of distributions under such a transformation. Consideration is restricted to transformations $y = t(x)$ where $t(0) = 0$ and $t(x)$ is analytic and biunique in an interval I containing the origin. It is demonstrated that every such transformation may be expressed as the product of the two transformations $z = s(x)$ and $y = z^N$ where N is an odd positive integer and $s(x)$ is an analytic and biunique transformation in a neighborhood of the origin and, in addition, $s'(0) \neq 0$. We consider first transformations of the type $y = x^N$ where N is an odd positive integer.

3. Definition: Let R be the class of rationals r such that $0 \leq r < 1$ and if $r = \frac{p}{q}$ where p and q are relatively prime, then q is odd. Order R so that $R = \{r_i\}_{i=0}^{\infty}$, $r_0 = 0$.

4. Definition: Let $\bar{D}(\bar{D}_0, \bar{D}_I)$ be the class of complex-valued functions f(x) which can be represented in the form $f(x) = \sum_i' x^{r_i} f_i(x)$ where $f_i(x) \in D(D_0, D_I)$, $r_i \in R$, and $\sum_i'$ is used to designate that the summation is over a finite subset of the positive integers.

It is demonstrated that the class $\bar{D}$ is mapped into itself by the transformations $y = x^N$ and $y = x^{1/N}$. Similar statements are demonstrated for the classes $\bar{D}_0$ and $\bar{D}_I$.

5. Definition: A linear functional $\bar{\Delta}(f)$ defined over $\bar{D}_I$ is called a formal measure if it has the following continuity property: there is a nonnegative integer n such that for any sequence of functions $\{f_i(x)\}_{i=1}^{\infty}$ with $f_i(x) \in \bar{D}_I$ $i = 1, 2, \ldots$ and such that $\{f_i^{(n)}(x)\}_{i=1}^{\infty}$ exists and converges uniformly to zero on I, then $\bar{\Delta}(f_i) \xrightarrow[i \to \infty]{} 0$.

A calculus is developed for formal measures similar to that developed for c.l.f.'s. It is demonstrated that formal measures are a generalization of c.l.f.'s, that is, if Δ is a c.l.f. defined over D_I, then there is a formal measure $\bar{\Delta}$ such that if $f(x) \in D_I$ then $\bar{\Delta}(f) = \Delta(f)$. Consequently, the mapping of c.l.f.'s is discussed by considering the mapping of formal measures.

6. Definition: Let $\bar{\Delta}$ be a formal measure defined over functions $f(x) \in \bar{D}_I$. The map $[T\,\bar{\Delta}]$ of $\bar{\Delta}$ [under the transformation $y = x^N$] is the functional defined over functions $g(y) \in \bar{D}_{T(I)}$ by the relation $[T\,\bar{\Delta}]\,[g(y)] = \bar{\Delta}[g(x^N)]$.

7. Definition: Let $\bar{\Delta}$ be a formal measure defined functions $g(y) \in \bar{D}_{T(I)}$. The map $[T^{-1}\,\bar{\Delta}]$ of $\bar{\Delta}$ is the functional defined over functions $f(x) \in \bar{D}_I$ by the relation $[T^{-1}\bar{\Delta}]\,[f(x)] = \bar{\Delta}[f(y^{1/N})]$.

With these definitions the following two important theorems are demonstrated.

8. Theorem: Let $\bar{\Delta}$ be a formal measure defined over functions $f(x) \in \bar{D}_I$. Then $[T\,\bar{\Delta}]$ is a formal measure defined over functions $g(y) \in \bar{D}_{T(I)}$.

9. Theorem: Let $\bar{\Delta}$ be a formal measure defined over functions $g(y) \in \bar{D}_{T(I)}$. Then $[T^{-1}\,\bar{\Delta}]$ is a formal measure defined over functions $f(x) \in \bar{D}_I$.

These theorems are generalized and it is demonstrated that the same theorems hold when T is any transformation $y = t(x)$ where $t(0) = 0$ and $t(x)$ is analytic and biunique on I. In addition it is shown that $T^{-1}[T\,\bar{\Delta}] = \bar{\Delta}$.

Microfilm $2.00; Xerox $3.00. 55 pages.

1. Schwartz, Laurent. Théorie Des Distributions. Tome I. Paris: Hermann and Cie., 1950.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

2. Schwartz, Laurent. Théorie Des Distributions. Tome II. Paris: Hermann and Cie., 1951.

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AN INVESTIGATION OF THE FLOW OF A VISCOUS COMPRESSIBLE FLUID PAST A SEMI-INFINITE FLAT PLATE AT ZERO ANGLE OF ATTACK

(L. C. Card No. Mic 59-2815)

Gerald Leland Davey, Ph.D.
Stanford University, 1959

This thesis studies the boundary value problem arising from the flow of a viscous, compressible fluid past a semi-infinite flat plate at zero angle of attack. Starting from the linearized Navier-Stokes equations, we utilize two different approaches: (i) we seek an analytic solution which will describe completely the nature of the flow, and (ii) we seek a uniform asymptotic expansion for the flow in terms of a small parameter, which, in this case, is the kinematic viscosity, ν.

We use transform theory to find the explicit components of the fundamental solution tensor for the linearized Navier-Stokes equations--for both the subsonic and supersonic cases. These are new results, for prior to this time, only asymptotic expansions of these components have been given. Although we have included the results for the supersonic case, we do not pursue this case any further.

A radiation problem, equivalent to the original boundary value problem, yields an integral equation, which can be solved theoretically by an extension to the method of Wiener and Hopf. Knowledge of the components of the fundamental solution tensor and their asymptotic behavior enable us to find bounds for the solution of this integral equation and hence for the boundary value problem. It turns out that the solution of the integral equation, which we are trying to solve, is physically related to the skin friction. Here we find the interesting result that the bound $(\frac{c}{\sqrt{x}})$ is the skin friction that one obtains by solving the same flow problem, but for a viscous, incompressible fluid.

Singular perturbation theory, in the second approach, suggests the form of the asymptotic expansion to try. A number of partial differential equations are then solved which give us the coefficients in this expansion. By using the results of the first approach, we can show that the correction terms in the asymptotic expansion are bounded. We thus obtain a unique and valid asymptotic expansion for the whole flow regime, which is a considerable extension to the boundary layer expansions of Prandtl. The results are consistent with the previous results, for the same type of singularity appears in both solutions at the origin.

Microfilm $2.00; Xerox $6.80. 143 pages.

SYMMETRIC RANDOM WALKS ON GROUPS

(L. C. Card No. Mic 58-5879)

Harry Kesten, Ph.D.
Cornell University, 1958

Let G be a countable group generated by $A = \{a_1, a_2, \ldots\}$. Consider a random walk on G in which a step consists of multiplication on the right by one of the generators or its inverse. One multiplies by a_i or a_i^{-1}, each with probability p_i. This random walk defines a Markov chain, the transition probability from g_1 to g_2 ($g_1, g_2 \in G$) being the probability that g_2 is reached in one step from g_1. Since G is countable this Markov chain can be represented by its matrix M(G) of transition probabilities. Let N be any normal subgroup of G. Then $K = G/N$ can be generated by $\{a_1N, a_2N, \ldots\}$. There exists a random walk on K in which at every step the probability of multiplying by a_iN or $a_i^{-1}N$ is p_i. Call the corresponding matrix of transition probabilities M(K). Let N itself be generated by $\{b_1, b_2, \ldots\}$ and define a random walk on N, in which at every step the probability of right multiplication by b_i or b_i^{-1} is q_i. Denote the corresponding matrix of transition probabilities by M(N). The spectral radii of the above matrices are denoted by $\lambda(G)$, $\lambda(K)$ and $\lambda(N)$ respectively. The following theorem is proved: $\lambda(K) > \lambda(G)$ if and only if $\lambda(N) < 1$.

As a corollary one obtains: If G is generated by $\{a_1, a_2, \ldots a_h\}$ $(1 < h < \infty)$ and $p_1 = \cdots = p_h = \frac{1}{2h}$, then G is a free group with free generators $a_1, \ldots a_h$ if and only if $\lambda(G) = \sqrt{\frac{2h-1}{h^2}}$.

Microfilm $2.00; Xerox $3.00. 35 pages.

ASYMPTOTIC BEHAVIOUR OF SOLUTIONS OF LINEAR ELLIPTIC DIFFERENTIAL EQUATIONS

(Publication No. 24,561)

Norman George Meyers, Ph.D.
Indiana University, 1957

Chairman: Professor David Gilbarg

This work is concerned with the behaviour of solutions of linear elliptic equations at infinity and at finite points. However the emphasis is on infinity.

Our only result at finite points is the generalization to elliptic equations of the classical theorems on removable singularities of harmonic functions. We show that if $L(u) = a_{\nu\mu}(x)\, u_{,\nu\mu} + a_{\nu}(x)\, u_{,\nu} + a(x)\, u = f(x)$ is an equation with Hölder continuous coefficients and u is a solution which is

$$\begin{cases} o(\log \frac{1}{r}), & n = 2 \\ o(r^{2-n}), & n > 2 \end{cases}$$ near the singular point then the singularity can be removed. The proof though lengthy is elementary. A short but non-elementary proof is also indicated which relies upon the solution of the boundary value problem. The Schauder estimates are used in the proof of this theorem and in fact play a crucial role throughout the entire paper. They allow us to pass from the known or established behaviour of the solution to the behaviour of its

derivatives. Thus when we turn our attention to infinity we first discuss the limit properties of the solution itself. One aspect which appears in our work is the close connection between the rate at which a and f tend to zero at infinity and the rate at which u tends to its limit. The precise form of this connection can be anticipated from potential theory but does not seem to be well known even in that case.

Having investigated the solution we then pass to its derivatives via the Schauder estimates. Various theorems on the rate at which the derivative of a solution approaches zero are derived together with Hölder conditions which they must satisfy in the neighborhood of infinity. For example under the appropriate conditions on the equation it is shown that if $u = O(r^{-\gamma})$ then the i-th derivatives are $O(r^{-\gamma-i})$. Such estimates as these probably represent the most important contribution of the paper.

Our final and most unexpected result involves the expansion of solutions about infinity. From potential theory and other considerations one expects that if the coefficients of the differential equation have power series expansions about infinity then the solution will also have this property. We prove that $u = u_0 + \text{const. } r^{2-n}$ a remainder which under certain conditions can be of the order of $r^{1-n} \log r$. This indicates that the expansion may contain terms of the form $r^{1-n-g} (\log r)^p$. Expansions containing such logarithmic terms have been derived by other authors for solutions in two independent variables. But the presence of such terms was thought to be caused by conditions peculiar to two dimensions.

Microfilm $2.00; Xerox $3.00. 45 pages. Mic 59-3162.

REVERSAL FUNCTIONS OF A TEST PROCEDURE AND THEIR ASSOCIATED BOUNDS WHEN DATA ARE INCOMPLETE

(L. C. Card No. Mic 59-2516)

Bernard Samuel Pasternack, Ph.D.
North Carolina State College, 1959

Supervisor: Junjiro Ogawa

The conduct of any statistical analysis generally involves the reduction of a sample, or experimental data, in such manner as to provide as much relevant information as is possible. Unfortunately, however, statisticians are sometimes confronted with situations in which data, originally intended to be part of the ensuing statistical analysis, are missing.

The main concern of this investigation involves the concept of "the probability of reversal." That is, the determination of the conditional probability of not rejecting the null hypothesis, H_0, if all the data were available, given that H_0 was rejected by the test of significance based on the incomplete data (Type 1). Or, on the other hand, the conditional probability of rejecting H_0 if all the data were available, given that H_0 was not rejected by the test of significance based on the incomplete data (Type 2). Therefore, "the probability of reversal" indicates the degree of stability in the statistical inference procedure when the originally designed experiment is disrupted by loss of observations. The reversal function (of Type 1 or Type 2) of a test procedure is defined as either of the above conditional probabilities, respectively, when considered as a function of H, the alternative hypothesis. Unfortunately, this type of conditional probability seems to be mathematically intractable except for the simplest cases at the present stage.

Consider a sample of size n, $x_1, x_2, \ldots, x_n$, drawn from $N(\mu,\sigma^2)$ (σ^2 known). Suppose only n-k observations are available, $x_1, x_2, \ldots, x_{n-k}$ (say). Let

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i , \quad \bar{x}^* = \frac{1}{n-k}\sum_{i=1}^{n-k} x_i ,$$

$$z = \sqrt{n}\,\frac{\bar{x}}{\sigma} , \qquad z^* = \sqrt{n-k}\,\frac{\bar{x}^*}{\sigma} ,$$

and define $z(\alpha)$ and $z^*(\alpha)$, respectively, by

$$P_{H_0}\{|z| \le z(\alpha)\} = 1 - \alpha , \quad P_{H_0}\{|z^*| \le z^*(\alpha)\} = 1 - \alpha ,$$

where H_0: $\mu = 0$. We define the quantity

$$P_H\{|z| \le z(\alpha) \mid |z^*| > z^*(\alpha)\} ,$$

α being prefixed, as the probability of reversal of type 1 under some hypothesis H, and the quantity

$$P_H\{|z| > z(\alpha) \mid |z^*| \le z^*(\alpha)\}$$

as the probability of reversal of type 2 under some hypothesis H. The probability of reversal of type 1 or 2 when regarded as a function of H, the alternative hypothesis, defines the reversal function of type 1 or 2, respectively, of this test procedure. In Chapter 2 tables have been constructed for the probability of reversal of type 1 and type 2 for prefixed α and H_0: $\mu = 0$, for different values of $\frac{k}{n}$, which corresponds to the proportion of the total number of observations which are missing. The reversal function, $P_H\{|z| \le z(\alpha) \mid |z^*| > z^*(\alpha)\}$, has also been tabulated ($\alpha = .0455$) for various values of $\frac{k}{n}$ under alternative H: $\mu = \mu$.

When σ^2 is unknown the test procedure depends upon t, or, for incomplete data, t^*. Let

$$s^2 = \frac{1}{n}\sum_{i=1}^{n} (x_i - \bar{x})^2 , \quad s^{*2} = \frac{1}{n-k}\sum_{i=1}^{n-k} (x_i - \bar{x}^*)^2$$

$$t = \sqrt{n-1}\,\frac{\bar{x}}{s} , \qquad t^* = \sqrt{n-k-1}\,\frac{\bar{x}^*}{s^*}$$

then, for $n-k \ge 2$, the minimum value of τ such that

$$P_{H_0}\{|t| > \tau \mid t^*\} = 0 ,$$

has been found. When k = 1, i.e., only one observation is missing, $\tau = +\sqrt{1 + \frac{n}{n-2}\,t^{*2}}$. If $t^* = 0$, then $\tau = \sqrt{\frac{(n-1)k}{n-k}}$. The derivation of the least upper bound for $|t|$ given t^*, stochastically, is contained in Chapter 3. An example illustrating a possible application of this bound is also given.

Extension of this type of result to the case of one-way classification is considered in Chapter 4 where both lower and upper bounds are obtained on F given F^* (defined analogously to t and t^*). Another example is also

presented. This theoretical approach is carried to formal completion for univariate analysis of variance in Chapter 5 where similar bounds are obtained when the general linear model is considered.

In Chapter 6 the randomized block is considered in some detail with special attention drawn to the mathematical nature of the randomization procedure, and the introduction of a chance mechanism according to which observations are missed. This suggests the line of research along which the author hopes to proceed.

Microfilm $2.00; Xerox $6.00. 122 pages.

THE MATHEMATICS OF THE UNDERGRADUATE ELECTRICAL ENGINEERING CURRICULUM

(L. C. Card No. Mic 59-2669)

Wilbert Neil Prentice, Ph.D.
Syracuse University, 1959

This dissertation is an analysis of the mathematical content of those electrical engineering courses, offered by Syracuse University, which all electrical engineering undergraduates are required to take. The texts in use during the year 1955-56 have been used as the basis of this analysis. These have been taken as being typical of a general undergraduate electrical engineering curriculum.

That engineering students need algebra, trigonometry, calculus, differential equations, Fourier series, and some complex variables is fairly well known. However, the individual mathematics topics required, their frequency of use, and the detailed mathematical development of the engineering courses is of interest to both the electrical engineer teaching his courses and the mathematician trying to prepare the student mathematically for these courses. Hence the form of presentation in this dissertation is via the detailed method of giving the mathematical development in a logical, rigorous fashion. In some cases new proofs have been supplied; in others, old trite proofs appear. Gaps in the logical development have been filled in or noted. An attempt, however, has been made to present a reasonably complete development to serve as a reference structure.

The concluding chapter of the dissertation is devoted to recommendations. These include an outline of a three-year sequence of mathematics courses which the electrical engineering student should take. The many mathematics theorems which the engineers implicitly or explicitly assume are listed, together with observations as to which theorems could easily be established in the engineering courses and the mathematics course in which each of the others should be established.

Electrical engineering students could also profit from a course which would give them a set of topological theorems and proofs adapted to the engineers' needs and the maturity of a junior engineering student. The treatments of network analysis and flux linkages, in particular, could then be made more rigorous.

The main mathematics theorems and definitions required in the engineering courses discussed in the dissertation are listed in the Appendix. The Appendix also gives an indication of the frequency of their use by listing the number of chapters in each course that require each theorem or definition.

Microfilm $3.75; Xerox $12.80. 292 pages.

NON-ANALYTIC FUNCTIONS

(L. C. Card No. Mic 59-1989)

Robert F. Tidd, Ph.D.
The University of Buffalo, 1959

The principal type of function considered in this work is a non-analytic function of the form $F(z) = U(x,y) + iV(x,y)$ where $U(x,y)$ and $V(x,y)$ are real polynomials in x and y satisfying the conditions $U_x = V_y$, $U_y = V_x$. The main idea investigated is the correspondence which can be set up between analytic functions and non-analytic functions under certain conditions. Correspondence is first discussed for functions which behave in a prescribed manner at certain isolated points. In this connection, both the functional values and the values of the derivatives are considered. The derivative of the non-analytic function is defined so that it is single valued. Next correspondence between the functions is discussed at points on a curve in the z plane where the first partial derivative of the real part of the non-analytic function vanishes. A polynomial in x and y which will serve as the first partial derivative of the real part of both the analytic and the non-analytic function is found. The same function will also serve as the mth partial derivative of the real part of both of these functions. The form of the non-analytic function satisfying these conditions is so similar to the form of the analytic function that it is possible to express the non-analytic function as a function of the new variable z^*, where z^* is defined as $z^* = x + ky$, $k = \sqrt{-1}$, $k^2 = 1$. Finally other non-analytic functions which are not polynomial functions of x and y are discussed. Methods are given for determining other non-analytic functions from known non-analytic functions.

Microfilm $2.00; Xerox $5.20. 102 pages.

LOCAL BEHAVIOR OF SOLUTIONS OF ELLIPTIC SYSTEMS OF PARTIAL DIFFERENTIAL EQUATIONS

(L. C. Card No. Mic 59-2677)

Elizabeth Harriet Wetherell, Ph.D.
Syracuse University, 1959

A linear system of partial differential equations in n independent variables $x_1, \ldots, x_n$ and N unknown functions $u_1, \ldots, u_N$ is a system of the form

$$\sum_{j=1}^{N} \ell_{ij}(x,D)u_j(x) = f_i(x), \quad i = 1, \ldots, N,$$

where each $\ell_{ij}(x,D)$ is a differential operator which may be written $\sum_{\rho=0}^{s_i+t_j} \sum_{i_1+\ldots+i_n=\rho} a_{i_j,i_1\ldots i_n}(x) \dfrac{\partial^{\rho}}{\partial x_1^{i_1} \cdots \partial x_n^{i_n}}$ if $s_i + t_j \geq 0$ and is identically zero if $s_i + t_j < 0$. It is

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assumed that the integers s_i, t_i have the property that max $s_i = 0$. Let $\ell'_{ij}(x,D)$ represent the sum of terms in $\ell_{ij}(x,D)$ which are exactly of order $s_i + t_j$ and let $m = \sum_{i=1}^{N} (s_i + t_i)$.

The system is called elliptic in a domain if there exist integers $s_1, \ldots, t_N$ such that at every point x of the domain the homogeneous polynomial in $\xi_1, \ldots, \xi_n$, $\det\{\ell'_{ij}(x,\xi)\}$, is non-vanishing, say positive definite, for every $\xi \neq 0$. The system is called uniformly elliptic if for some positive constant K, $\det\{\ell'_{ij}(x,\xi)\} \geq K|\xi|^m$.

Two theorems concerning homogeneous linear systems which are uniformly elliptic in a neighborhood of the origin are proved. It is assumed in both that $n > m$ and that in a neighborhood of the origin the coefficients $a_{ij,\rho}(x)$ have Hölder continuous derivatives up to order $-s_i$ and, in particular, that the coefficients of derivatives of order $s_i + t_j$ have Hölder continuous derivatives up to order $-s_i$ with exponent ϵ. For elliptic equations and systems the solutions are as smooth as the equations permit. Thus a solution $(u_1, \ldots, u_N)$ of the system with coefficients satisfying the above conditions has the property that, for each j, u_j has Hölder continuous derivatives up to order t_j.

The first theorem proved is the following: Let $(u_1, \ldots, u_N)$ be a solution defined near the origin which vanishes at the origin in such a way that for some integer M such that $M + t_j > 0$ for $j = 1, \ldots, N$ we have

$$u_j(x) = 0(|x|^{M+t_j}), \quad j = 1, \ldots, N,$$

and for at least one j, say j_0, $u_{j_0}(x) \neq 0(|x|^{M+t_{j_0}+1})$. Then there exist homogeneous polynomials $p_j(x)$ of degree $M+t_j$, not all of which are identically zero, such that $(p_1, \ldots, p_N)$ is a solution of the tangential system $\sum_{j=1}^{N} \ell'_{ij}(0,D)u_j = 0$, $i = 1, \ldots, N$, and

$$u_j(x) = p_j(x) + 0_{t_j}(|x|^{M+t_j+\epsilon}), \quad j = 1, \ldots, N,$$

where this notation is abbreviation for the equations

$$\frac{\partial^\nu u_j(x)}{\partial x_1^{i_1} \ldots \partial x_n^{i_n}} = \frac{\partial^\nu p_j(x)}{\partial x_1^{i_1} \ldots \partial x_n^{i_n}} + 0(|x|^{M+t_j-\nu+\epsilon}), \nu = 0, \ldots, t_j.$$

To prove the theorem an integral representation (analogous to a Green's representation) is obtained for functions u_j which have Hölder continuous derivatives up to order t_j. This representation involves using the fundamental solution $J(x-\xi)$ of the elliptic equation with constant coefficients $\det\{\ell'_{ij}(0,D)\}u = 0$ and may be written

$$u_j(x) = \sum_{k=1}^{N} \ell^{jk} \int_{|\xi|<R} \zeta(\xi)\, J(x-\xi)\, F_k(\xi)d\xi + v_j(x),$$

$$|x| \leq \frac{R}{2}, \quad j = 1, \ldots, N,$$

where $v_1, \ldots, v_N$ is a solution of the tangential system and $\zeta(\xi)$ is an infinitely differentiable function such that $0 \leq \zeta(\xi) \leq 1$ for all ξ, $\zeta(\xi) = 1$ for $|\xi| \leq R/2$, and $\zeta(\xi) = 0$ for $|\xi| \geq 3R/4$. After estimates have been made to show that

$$u_i(x) - v_i(x) = \sum_{\nu=0}^{M+t_i} q_\nu^{(i)}(x) + 0(|x|^{M+t_i+\alpha}), \quad i = 1, \ldots, N,$$

where each $q_\nu^{(i)}(x)$ is a homogeneous polynomial of degree ν and $(q_{M+t_1}^{(1)}(x), \ldots, q_{M+t_N}^{(N)}(x))$ is a solution of the tangential system, the proof is easily completed by using a corollary derived from basic interior estimates for solutions of elliptic systems obtained by Douglis and Nirenberg.

The second theorem proved is an existence theorem for an elliptic system for which all the s_i are zero and all t_j are equal. It is shown that for all non-negative integers $i_1^{(j)}, \ldots, i_n^{(j)}$ $(j = 1, \ldots, N)$ such that $0 \leq i_1^{(j)} + \ldots + i_n^{(j)} \leq t-1$ there exist solutions which are defined for small values of $|x|$ and are of the form

$$u_j = x_1^{i_1^{(j)}} \ldots x_n^{i_n^{(j)}} + 0_t(|x|^t), \quad j = 1, \ldots, N.$$

To prove this theorem a Banach space B is constructed and a linear operator T in B is defined. It is shown that the bound of T, $\|T\|$, is less than 1 so that for every element h in B the equation U = h+TU has a unique solution for which the norm of U satisfies the inequality $\|U\| \leq \|h\|/(1-\|T\|)$. The operator T is defined in such a way that if h is a solution of the tangential system the corresponding vector U (defined by the equation U = h+TU) is a solution of the original system. Using this fact the proof of the existence theorem is reduced to showing that a certain system of homogeneous linear equations has only the trivial solution. This is verified by obtaining an estimate with the aid of the above inequality for $\|U\|$ and the properties of the norm. Microfilm $2.00; Xerox $5.00. 98 pages.

ALGEBRAIC LAPLACIAN AND DISCRETE BOUNDARY VALUE PROBLEMS IN A SIMPLICIAL COMPLEX

(L. C. Card No. Mic 58-7246)

Kapbyung Yoon, Ph.D.
Syracuse University, 1958

Supervisor: W. R. Baum

1. Let D be an open domain in an Euclidean space, and K be an 1-dimensional complex imbedded in D. Corresponding to an arbitrary scalar field f of D, we obtain a 0-dimensional chain c^0 of K by the following way:

$$c^0(A) = f(A) \equiv \int_A f,$$

where A is an arbitrary vertex of K. Corresponding to an arbitrary vector field $\iint$ of D, we obtain an 1-dimensional chain c^1 of K by the following way:

$$c^1(\sigma^1) = \int_{\sigma^1} \iint d\Pi,$$

where σ^1 is an arbitrary edge of K. By this assignment of f to c^0, and $\iint$ to c^1, grad.f corresponds to δc^0, hence δ gives a discrete analogy of the operation grad.. The well known Stokes' formula is $\int_D \text{div.} \iint dS = \int_{\partial D} \iint . \alpha\, ds$.

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Analogous to this formula, we have $\int_A \partial c^1 \equiv \partial c^1(A) = c^1(\delta A) \equiv \int_{\delta A} c^1$, where A is an arbitrary vertex of K, and we take this vertex A and its star σA as the analogies of a domain D and its boundary ∂D. Thus ∂ gives an analogy of div.. With these analogies of grad. and div., we can construct a Vector Analysis in the real spaces of chains.

2. An m-covector field $A_{i_1 \ldots i_m}$ is an absolute covariant tensor field of rank m, where the coefficients $A_{i_1 \ldots i_m}$ are skew-symmetric with respect to the indices $i_1, i_2, \text{---}, i_m$. The integral of an m-form, i.e. a formal linear combination

$$A = \sum_{i_1 < \ldots < i_m} A_{i_1 \ldots i_m} \, dx_{i_1} dx_{i_2} \text{---} dx_{i_m},$$

where $A_{i_1 \ldots i_m}$ is an m-covector field in an Riemannian manifold, over an oriented m-simplex E^m is defined in [3] Section 19, and denoted by $\int_{E^m} A$. From an m-form A, we can define an m-dimensional chain u by $u(E^m) = \int_{E^m} A$ for each m-simplex E^m. The assignment of a 0(1)-dimensional chain to a scalar (vector) field described in Paragraph 1 is a special case m = 0(1) of this assignment.

3. For a scalar field f, Laplacian Δ is defined by div. grad., which has an analogous operation $\partial\delta$ in chain spaces. We can define (algebraic) Laplacian in a complex as

$$\Delta = \partial\delta \quad \text{in 0-dimensional case ----- (1).}$$

We can formally extend this definition:

$$\Delta = \partial\delta \quad \text{in each dimension.}$$

If A is an (m - 1)-dimensional form, then the differential (exterior derivative) $dA = A_x$ (See [3] p. 78) is an m-dimensional form and if by the assignment of Paragraph 2 A corresponds to c, then dA corresponds to δc. The transposé métrique $\bar{\delta}$ of the operation d, which is defined by $(dA, B) = (A, \bar{\delta} B)$, where (A, B) is the scalar product ([4] p. 124), has an analogous operation ∂ in chain spaces. Thus the Laplacian $\bar{\Delta} = \bar{\delta} d + d \bar{\delta}$ defined in [4] p. 125 gives an analogous form $\Delta = \partial\delta + \delta\partial$ in chain spaces, which is another extension of the definition (1).

4. Algebraic Laplacian is defined as either $\Delta = \partial\delta$ or $\Delta = \partial\delta + \delta\partial$, where ∂ and δ are the usual boundary and coboundary operations of the real vector spaces of chains. According to a partition (I, B) of the set of all m-dimensional simplices, we can consider the following boundary value problems: Find an m-dimensional chain u which satisfies

$$\Delta u = g \text{ on I, and } u = h \text{ on B},$$

where g and h are arbitrarily given chains of V_I and V_B, linear subspaces spanned by the elements of I and B respectively. If g = 0, then this problem always has at least one solution. A n.a.s.c. for the homogeneus 1st boundary value problem (the case g = h = 0) to have only the trivial solution u = 0 is

$$(C_m) \quad V_I \cap Z^m = 0 \quad \text{when } \Delta = \partial\delta$$

$$\text{or } (D_m) \quad V_I \cap \mathcal{H}^m = 0 \quad \text{when } \Delta = \partial\delta + \delta\partial,$$

where Z^m and $\mathcal{H}^m$ are the spaces of cocycles and harmonic chains (For definition, see [1]). Under this condition, i.e. (C_m) when $\Delta = \partial\delta$ or (D_m) when $\Delta = \partial\delta + \delta\partial$, the 1st boundary value problem has always a unique solution.

5. The 2nd boundary value problem: Find an m-dimensional chain u which satisfies

$$\Delta u = g \text{ on I}$$

$$\left.\begin{array}{l} \delta u . \delta b \\ \text{or} \quad \delta u . \delta b + \partial u . \partial b \end{array}\right\} = h.b \text{ for all b of B},$$

$$\text{according to } \Delta = \begin{cases} \partial\delta \\ \partial\delta + \delta\partial \end{cases}$$

A n.a.s.c. for the existence of a solution is

$$\left.\begin{array}{l} (g + h) . Z^m \\ (g + h) . \mathcal{H}^m \end{array}\right\} = 0$$

Moreover, the solution is unique modulo $\begin{cases} \text{cocycles} \\ \text{harmonic chains.} \end{cases}$

6. The 3rd boundary value problem: Find an m-dimensional chain u which satisfies

$$\Delta u = g \text{ on I}$$

$$\left.\begin{array}{l} \delta u . \delta b \\ \delta u . \delta b + \partial u . \partial b \end{array}\right\} + \lambda_b u.b. = h.b. \text{ for all b of B},$$

where λ_b's are given positive numbers.

Under condition $\begin{cases} (C_m) \\ (D_m) \end{cases}$, this problem has always a unique solution.

7. Let (C, D) be a partition of all (m + 1)-dimensional simplices which satisfies

$$(E_m) \quad \partial V_D \subset V_I, \; V_D \supset \mathcal{Z}_{m+1},$$

where V_D is the real vector spaces over the simplices of D, and $\mathcal{Z}_{m+1}$ is the space of (m + 1)-dimensional cycles. Another form of the 2nd boundary value problem: Find an m-dimensional chain u such that

$$\partial\delta u = g \text{ on I, and } \delta u = f \text{ on C}$$

for given g of V_I and f of V_C. A n.a.s.c. for this problem to have a solution is $(g - \partial f) . Z^m(K^*) = 0$, where K^* is the complex made of the simplices of D,I and their faces. Furthermore, the solution is unique modulo cocycles.

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Microfilm $2.00; Xerox $3.00. 36 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

THE EFFECT OF SOLID SOLUBILITY ON THE SYNTHESIS, STABILITY AND POLYTYPISM OF THE MICAS

(L. C. Card No. Mic 59-2879)

Michael Summers Crowley, Ph.D.
The Pennsylvania State University, 1959

The effects of solid solution on the properties of the common micas were determined by the conventional techniques of hydrothermal synthesis, the products being evaluated by X-ray diffraction methods and, in some cases, by infra-red analysis and optical microscopy.

The limit of Mg^{2+}-substitution into the muscovite structure was found to be at the phengite composition, $K_2MgAl_3(AlSi_7)O_{20}(OH)_4$. This limit was determined by the shift in cell dimensions and the phase assemblages present after synthesis. The main effect of the Mg^{2+}-substitution is to promote the formation of the 3T polytype at low temperatures (below 600°C). Also, the decomposition temperature is slightly raised. The reactions, muscovite decomposing to sanidine and corundum, and sanidine plus corundum forming sanidine, mullite, and leucite, have been found to be reversible, and pressure-temperature curves for these reactions are given.

The limits of solid solution of Al^{3+} into the phlogopite structure is the composition $K_2Mg_4Al_2(Al_4Si_4)O_{20}(OH)_4$, which corresponds to the amesite composition reported as the limiting member for Al^{3+}-substitution in the chlorites. The polytype formed by the ideal phlogopite composition was not affected by Al-substitution, only the 1M variety formed. The phlogopite decomposition curve reported in the literature appears to be low by about 100°C but the results of this investigation are not unequivocal.

Almost 10% of ferric iron can be accommodated in the muscovite structure, substituting for Al^{3+}. The polytype relationships are not changed but the decomposition temperature is lowered slightly.

The limit of solid solution of ferric iron into the phlogopite structure, as deduced from cell dimension changes and refractive indices, is the composition $K_2Mg_5Fe(Fe_3Si_5)O_{20}(OH)_4$. The effect of iron substitution is to lower the decomposition temperature by about 100° C, the polytype relations remaining constant.

The introduction of fluorine into the dioctahedral starting material has very little effect on the micas synthesized. It cannot be proven, however, that fluorine actually enters the structure or if it substitutes for oxygen as well as hydroxyl.

The most interesting development encountered was the fact that the dioctahedral micas, and chlorites, can undergo a change in cell dimensions as a function of the pressure at which they were synthesized. This phenomenon of cell contraction with increasing formation pressure is exhibited by muscovite and clinochlore but not by phlogopite or pyrophyllite and is attributed to Al-Si ordering in the tetrahedral layer coupled with a defect, such as a vacancy, in the octahedral layer. One result of this phenomenon is to open to question measurements on cell dimensions and solid solubility based on synthetic standards.

The problem of reaction rates in hydrothermal synthesis has been approached in a qualitative way by using crystalline starting materials and measuring the growth of the product (mica) at the expense of the reactants. This technique is not adequate to obtain accurate data on the rates of reaction. Probably of greater interest is the mechanism of reaction in hydrothermal synthesis. Experiments with macroscopic pieces of feldspar and gibbsite (or hydromagnesite) have shown that the reaction proceeds by solution of the reactants and precipitation of the product. Microfilm $2.00; Xerox $5.20. 105 pages.

HIGH-PRESSURE STUDIES OF THE SYSTEMS Mg_2GeO_4-Mg_2SiO_4 AND GeO_2-SiO_2 WITH SPECIAL REFERENCE TO THE OLIVINE-SPINEL TRANSITION

(L. C. Card No. Mic 59-2880)

Frank Dachille, Ph.D.
The Pennsylvania State University, 1959

Phase equilibrium studies have been extended by more than one order of magnitude beyond pressures attainable in hydrothermal systems. Pressures close to 900,000 psi have been obtained by the use of relatively simple uniaxial devices in which a large force is applied to a sample for tens of hours by means of very hard tool steel or cemented carbide pistons with small bearing surfaces. The sample is pressed into a thin nickel ring and isolated from the piston faces by platinum foils. Temperatures of 550-600° C are the practical upper limits at the extreme pressure range. Tests have been made which show that the pressure is uniform across the sample assembly, and further, that the results are comparable to those obtained with hydrostatic pressure.

The system Mg_2GeO_4-Mg_2SiO_4 above 500° C has been studied to the limits of the hydrothermal and uniaxial methods. It has been determined that the olivine-spinel phase transition is reversible and reproducible. The univariant p-t curve for this transition for Mg_2GeO_4 passes through 823°C at 10,000 psi and increases at the rate of 24.6 ± 1.2°C to 80,000 pai. The ΔV of the two phases at room temperature and pressure is 3.5cc per mol. The ΔH of the transition calculated via the Clapeyron relation is 3.7 Kcal/mol. The maximum silicate content of the spinel solid solution obtained is 53 mol percent at 65 kilobars and 542°C. Extrapolation of the phase fields shows that Mg_2SiO_4 should convert to the spinel form at 100 ± 15 kilobars at 542°C. Other considerations suggest that the transition temperatures should rise 13°C per kilobar.

Assuming linear variation of x-ray "d-spacing" data with composition for the spinel solid solutions, the spinel phase of Mg_2SiO_4 will have a cell edge of 8.22Å. Thus the ΔV of transition for Mg_2SiO_4 would be only 2.0 cc per mol.

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The geophysical implication of these results is that an olivine-spinel transition in the mantle of the earth does appear to be a likely explanation of the seismic and density discontinuities at the 400 km depth as suggested by Jeffreys and Bernal provided that the mantle composition is in fact olivine, and that the temperatures in the mantle are in the range proposed by Daly or Turner and Verhoogen.

Uniaxial high pressure studies in the system GeO_2 SiO_2 at 500°C locate the quartz-coesite transition for SiO_2 at 20.4 ± 0.4 kilobars. The quartz solid solution field is reduced from 33 mol percent GeO_2 at low pressures to essentially nothing at the eutectoid pressure of 32 kilobars and 13 mol percent GeO_2, leaving SiO_2 (coesite) and GeO_2 (rutile).

A beginning has been made in the use of infra-red data for diagnostic purposes in the solid state. An empirical relation has been worked out which allows comparison of coordination polyhedra about major cations in simple compounds. The infra-red data lead to the conclusion that the 4^+ cations of silicates and germanates with the olivine structure are situated in distorted tetrahedra characterized by two pairs of oxygens in different equivalent coordinations to the cation. It also leads to the proposal that the Mg_2SiO_4 spinel will have the normal structure, and that Mg_2GeO_4 spinel has the inverse structure. Some x-ray corroboration of this fact has been found in relative intensities of the (422) and (400) reflections. According to earlier calculations for Mg_2GeO_4 spinel, the type may be distinguished by the I422/I400 ratio and would be normal, disordered or inverse if the ratio were 1.67, 3.3 or 6.6 respectively. In the present work the ratio found was always above 3.8 and as high as 6.5 for Mg_2GeO_4.

Microfilm $2.00; Xerox $4.40. 83 pages.

GRANITIC ROCKS OF THE NORTHERN PORTION OF THE INYO BATHOLITH

(L. C. Card No. Mic 59-2881)

Donald Orville Emerson, Ph.D.
The Pennsylvania State University, 1959

Granitic rocks of the McAfee Ranch quadrangle portion of the Inyo batholith, California-Nevada, underlie 120 square miles, of which two granodiorite plutons comprise 18 percent, a prophyritic adamellite comprises 28 percent, an adamellite, which is texturally divisible into a fine-grained, a medium-grained and a porphyritic facies, comprises 51 percent and two isolated adamellites comprise 3 percent. These units, sampled on a one mile grid and by traverses across contacts, are in sharp intrusive contact with each other, as well as with the sediments. Modes of hand samples from within each pluton show little variation and there are such significant differences between these rock units that a single sample from any unit will usually serve to characterize the pluton. The plutons were intruded in a mafic to felsic sequence and the later adamellites have altered portions of the early granodiorites.

The Pellisier granite, which became classical example of granitization after G. H. Anderson's 1937 article on the Northern Inyo Range, consists of several separate units in this area. These units include some that are metamorphic but not granitic (schists and gneisses) and the two distinctive plutons of granodiorite. The "pseudo-sedimentary structure in granite" described by Anderson is the result of weathered bands being uplifted by repeated movement on a recent fault. The granodiorite portions of the Pellisier granite are generally separated from the sediments by an aureole of medium-grade contact metamorphism only a few feet thick instead of broad transitional zones as described by Anderson.

Plagioclase compositions are homogeneous within plutons and range from an average of An_{35} in the granodiorites to An_{23} in the major adamellite. Microcline perthite, of predominantly maximum microcline triclinicity, but with a complete range of intermediate structural states, varies within a narrow compositional range and contains an average of 80 percent Or, 18 percent Ab and 2 percent An. Isorthoclase, previously described from the area, is probably an intermediate microcline which lacks microcline twinning.

Variations in modal compositions and normative compositions calculated from modes are directly related to the experimentally located thermal valley which controls the compositions of liquids in the system SiO_2 - $NaAlSi_3O_8$ - $KAlSi_3O_8$, or to recrystallization at low temperatures during the cooling of an intrusive. Only limited areas of migmatites and gneisses occur, both of which are regarded as by-products of magmatic intrusion, and it is apparent that this classic area of "extensive" granitization can no longer be cited as evidence of the metamorphic origin of granite.

Microfilm $2.05; Xerox $7.20. 153 pages.

THE PETROLOGY OF THE BLAIRMORE GROUP, ALBERTA, CANADA.

(L. C. Card No. Mic 59-2903)

George Barry Mellon, Ph.D.
The Pennsylvania State University, 1959

The Lower Cretaceous Blairmore group of the southern and central Alberta foothills consists of from 1500 to 2000 feet of predominantly non-marine strata that can be divided into three distinct lithologic (i.e. petrographic) members: a Lower sequence of quartzose graywackes and associated fresh-water limestones; a Middle sequence of feldspathic, high rank graywackes; and an Upper sequence of low rank graywackes that grade up into the Crowsnest pyroclastics in southern Alberta.

Petrographic analysis of mineral composition and grain size of the Middle member is based upon 66 sandstone samples from four localities. The detrital constituents have an average composition of 15 per cent quartz, 20 per cent feldspar (mostly sodic plagioclase), 65 per cent rock fragments and matrix, and accessory biotite and heavy minerals. The plagioclase and many rock fragments are of volcanic origin, derived from a spilitic terrane, whereas biotite, potash feldspar, and some quartz are of inferred acidic, pyroclastic origin.

The authigenic constituents include chlorite, quartz, kaolinite, montmorillonite (?), zeolite, and calcite. Chlorite is distributed homogeneously over the area of a thin section, whereas the other minerals occur as silicate- and

calcite-impregnated patches. The amount of authigenic cements is inversely proportional to the amount of "flexible" or porosity-destroying detrital constituents, but variation in the composition of the authigenic silicates is related to the composition of the detrital constituents. The observed silicate associations are interpreted as phases in a three or four component system, giving rise to characteristic assemblages that can be plotted on a ternary diagram. Calcite appears to be independent of the physical and mineral eralogical composition of the detrital constituents, and authigenic processes in these rocks are construed as a "normal" sequence of silicate cementation that can be interrupted at any time by the crystallization of calcite.

Interrelationships of the mineral constituents and grain size are summed up by factor analysis. Three factors were obtained, which are interpreted as reflecting the effects of (1) selective sorting, (2) authigenesis, and (3) petrographic changes in the source terrane, on the variation in the observed proportions of mineral constituents.

Less detailed petrographic analysis of the Lower and Middle members is based upon examination of 24 samples from three localities. Sandstones of the Lower member contain a high proportion of siliceous detritus and igneous material is absent. Fine-grained rock fragments are largely shale, argillite, siltstone, and clastic carbonate fragments derived from pre-existing sediments. The more heterogeneous sandstones of the Upper member range from quartzose graywackes to graywackes containing abundant micaceous slate and phyllite fragments, and moderate proportions of volcanic detritus. The detrital composition of these rocks is partly transitional from the quartzose graywackes of the Lower member to the volcanic graywackes of the Middle member, a transition that is also reflected in the composition and textures of the authigenic constituents.

The Lower and Middle members, and their "primitive" flora, can be traced as continuous rock units from Mill Creek to Cadomin. The Upper member, with its characteristic dicotyledonous flora, is present only in the south, disappearing northward through erosion or non-deposition. The distribution of red and non-red strata and coal seams defines three lateral facies that cut across the boundaries of the petrographic members, indicating a regional physiographic slope from south to north at the time of deposition. The terms "Luscar" and "Mountain Park" coincide with the trend of these lateral facies, and should be dropped as formational units in favor of the better defined petrographic members.

Microfilm $3.85; Xerox $13.00. 298 pages.

MUSIC

THE EFFECTS OF STIMULATING AND RELAXING MUSIC ON CHILDREN TAKING A FOURTH GRADE ARITHMETIC TEST

(L. C. Card No. Mic 58-7225)

George William Kopp, Ed.D.
Syracuse University, 1958

Purpose

This study was conducted to discover any fluctuations in arithmetic test scores which might be attributed to the presence of relaxing or stimulating music.

Method

A sampling group of 319 fourth grade children from the public schools of Dewitt, Fayetteville and Manlius in New York State were divided into three test groups. Data were collected to determine the possibility of significant differences in three independent test situations:

Test Group I -- Differences between scores on tests with relaxing music and those with no music.

Test Group II -- Differences between scores on tests with stimulating music and those with no music.

Test Group III -- Differences between scores on tests with relaxing music and those with stimulating music.

Within each test group, individuals were given a standardized arithmetic test and later a comparable form of the same test. Classical music backgrounds for the testing were taped recordings of a music therapy record, the result of research in mood classification of music.

Achievement scores were tabulated independently and a statistical analysis done to determine significant differences within each test group. A statistical technique was used whereby group scores were pooled, differences calculated, and the means of the difference distributions tested in relation to zero ($M_D = 0$).

A preference questionnaire was administered to determine individual attitudes toward taking tests with music as well as past experience in listening and working with classical background music.

Results

Computed t values for all groups were tested for significance at the .05 level of confidence. Tests of significance indicated the following:

Test Group I -- No significant differences between test scores obtained with relaxing background music and those obtained with no music.

Test Group II -- No significant differences between test scores obtained with stimulating background music and those obtained with no music.

Test Group III -- No significant differences between test scores obtained with relaxing background music and those obtained with stimulating background music.

The preference questionnaire indicated high percentages

that with either relaxing or stimulating music, the experience was enjoyable and the music not distracting. It was also reported that approximately one-half of the sampling had previous experience listening and working with classical background music.

Conclusions

1. Fourth grade boys and girls from the three test schools tend not to be distracted by relaxing or stimulating music played during an arithmetic test. Groups tested in the manner of this study will perform about the same with or without background music.
2. There seem to be no significant differences between relaxing and stimulating classical music when used as background for arithmetic testing.
3. Children enjoy taking tests with music and do not consider relaxing or stimulating music as distracting.
4. Group results support the above conclusions though variations of response are evident on an individual basis.
5. The findings generally agree with most of the previous research in other curriculum areas or with different age groups. There is a departure in the conclusion that stimulating music does not distract.
6. The investigator feels that this study provides some experimentally-sound evidence that children can work efficiently while accompanied musically. Further studies should seek additional support by investigating other factors involved in the classroom use of music. Once evidence is definitive that music can be used with many activities, the way is free to a long range study of the effects of music on school children. Such investigations may reveal that the presence of music has psycho-emotional effects similar to those reported in music therapy and industrial music. The use of background music over a long period of time may also be a way to build sound aesthetic values in music. Microfilm $2.00; Xerox $6.40. 132 pages.

MORAVIAN MUSIC IN SALEM; A GERMAN-AMERICAN HERITAGE

(L. C. Card No. Mic 59-333)

Donald Macomber McCorkle, Ph.D.
Indiana University, 1958

One of the most serious lacunae facing the student of early American music is the work of the 18th and early-19th century Moravians (Moravian Church) in Winston-Salem, N. C., and Bethlehem, Pa. The projected writing of a comprehensive history of the American Moravians presupposes that exhaustive studies will have been completed in the archives of both the Northern Province (Bethlehem) and the Southern Province (Winston-Salem) of the Moravian Church in America. Moravian Music in Salem is the first attempt to survey and critically appraise the musical culture of the Moravians of Salem and vicinity during the sixty years between 1780 and 1840.

The musical heritage of Salem is German-American. And it is a heritage which, from the sheer vitality of the community's musical activities and the high quality of individual musicians' contributions, cannot be equaled in the southern United States. There were in the 18th century, of course, other communities, Charleston, South Carolina, for example, which produced more luxurious concerts than did Salem, but none of these communities either produced notable composers, or encouraged the majority of the inhabitants to participate in musical activities. On the contrary, the musical culture was most often directed by itinerant musicians who traveled from one town to another presenting benefit (for themselves) concerts. Otherwise, the concerts were semi-private subscription performances, such as those of the St. Cecilia Society in Charleston, in which "gentlemen amateurs" sat in with a few professional musicians.

In Salem the entire community was musically conscious: Everyone was encouraged to sing chorales, and, if able, to sing in the choir; music was taught both in the schools and by private lessons; each important occasion was accompanied by the brass choir; and for entertainment the Collegium musicum assembled to run through the latest chamber and orchestra works from Europe. There was no place in this unique culture for the itinerant virtuoso or his benefit concert; here the musical creativity was indigenous and open to all.

Although several prominent Moravian composers (especially Simon Peter, Jacob van Vleck, Peter Wolle, Johannes Herbst, Johann Christian Bechler, Francis Florentine Hagen and Edward W. Lineback) were resident in Salem at one time or another, the name which looms largest to the fore is Johann Friedrich, or John Frederik, Peter. Peter was the most gifted of all his American Moravian colleagues, and on whom, the author believes, will eventually be placed the laurel wreath as the finest of all early American composers of sacred music. His anthems, arias, and quintets, only now being rediscovered after a long silence, are rapidly being assimilated in American music literature, and we may fully expect that their impact, while very belated, will nonetheless be significant.

Peter was the first to impart a sense of direction to the musical activities in Salem. He organized the Collegium musicum Salem, and thus the church orchestra also, prepared the music and directed the choir, played and taught others the organ, and generally raised the musical standards to a comparatively high level before his return to the Northern Province in 1790. It is most probable, too, that his own creative development reached maturity in his Salem years. We have seen in Chapter VI the products of this period, and have ventured the opinion that these Salem compositions are among the finest fruits of his entire career.

After Peter's recall to the North the musical life in Salem continued to develop until it very nearly equaled that in Bethlehem. The Collegium musicum grew in size and scope to the place where it could boast of as fine and representative a library as any musical society in America. Its day was soon to wane, however, and in its place was shortly to come a more democratic enterprise: the brass band which could utilize more players and less highly trained musicians. Therefore, it is to the Salem Band and to the Salem College School of Music to which we must inevitably look for the greatest influence exerted by the North Carolina Moravian musicians. While other ensembles

continued the Moravian musical tradition for a number of years, it is these two organizations which have prospered continuously since the Civil War. The Civil War naturally curtailed all cultural activities in Salem and caused the community to decline, the effect of which only now is being overcome. But this is a study beyond the scope of the present dissertation.

In this dissertation we have traced the musical heritage of Salem through its most creative period, beginning with the Peter era (1780-90) and ending after the first quarter of the 19th century. Always we have related Salem's culture to that in the other Moravian communities in the attempt to re-establish the proper balance between them. It has become increasingly obvious to the author that Bethlehem and Salem were mutually dependent centers of 18th and 19th century Moravian musical life. Recalling the statement in Chapter IV (p. 58): "Generally speaking, the picture is an analogous one. Because of the frequent exchange and interchange of music and personnel, which was the general rule among the Moravian towns, we must expect that the basic resources for music making would have been practically equal. It is in the development of these basic resources, however, where we will find the individual dissimilarities."

Are we justified in considering the musical culture of Salem as an American heritage? We are indeed. In its essentials Moravian music and its practice were certainly Italo-Germanic in orientation, and therefore began as transplants on foreign soil. It was not long, however, before the effects of American provincialism began to have their mutatious influence on the composers. No longer were their compositions near-facsimiles of contemporary European works, but genuinely indigenous creations written expressly, to borrow Latrobe's words, "for the service of the Lord, and the promotion of His glory on earth." The "melting pot" into which poured the many European cultures for the inevitable coagulation of the mass which became the American culture received the musical heritage of the Moravians as well. It is not for us to solve the academic question of how "American" was early American music. Moravian music in Salem is a German-American heritage which, by its very existence on American soil, has maximal significance to the history of music in America. Microfilm $5.50; Xerox $19.60. 431 pages.

THE PARODY MASS TECHNIQUE OF PHILIPPE DE MONTE. (VOLUMES I AND II).

(L. C. Card No. Mic 59-2449)

George Albert Michael, Ph.D.
New York University, 1959

Adviser: Dr. Gustave Reese

This study opens with a tabulation of all Monte's known Masses. Here an effort is made to correct and to bring up to date the information provided in the listing of the Masses by G. van Doorslaer in his La Vie et les oeuvres de Philippe de Monte (Brussels, 1921). Of the 48 Masses enumerated by Doorslaer, 6 turn out to be duplications of other Masses, 3 do not exist in the manuscripts referred to, and 9 are now unobtainable, having been lost or destroyed during World War II or being located in Russian-occupied countries (7 Masses may be presumed to survive in these areas). In other words, 30 Masses are presently available for study, 7 may exist in Wroclaw (Breslau), Poland, and 2 (undoubtedly destroyed at Cologne during World War II) are almost certain to be irretrievably lost.

The tabulation is followed by a brief survey of Monte's life and career.

The major portion of the study concerns Monte's treatment of the parody technique itself and, beginning with the elementary procedure of his setting a portion of the Mass text to a portion of the music of the pre-existent composition very much as that reaches him, moves progressively through procedures that are more complex to others that are highly so. Among the topics discussed are the following: fairly strict use of the polyphony of the model, the polyphony of the model reworked, subjects presented out of order, use of accidentals differing from that appearing in the model, new lines derived from old ones, transposed subjects, subjects combined or made to overlap, subjects worked out in imitation (whether or not set forth in imitation in the original), development, part-writing involving more or fewer voices than appear in the model, and the use of material not derived from the pre-existent composition. Monte's parody writing is characterized by a high degree of imagination in reworking the polyphony of the model. He permits himself a great deal of freedom when working with music that is imitative in nature. Patterns of vertical and horizontal distances in the model are frequently replaced by new ones. A melodic fragment is often extracted from the polyphonic web and made to serve as the basis for a relatively long section of the Mass, this sometimes actually amounting to a true development section in the modern sense of the word. Monte delights in substituting original writing for one or more lines of the model, and many Masses include long sections in which no reference is made to the pre-existent composition. One of the most characteristic features of his writing is the great care given to the proper accentuation of individual syllables and words of the text, even though this sometimes requires that a change be made in the pre-existent music.

A concluding summary of the text proper states more concisely those general principles of Monte's parody writing that have been deduced through detailed analysis of the music examples.

The Appendix includes a transcription of the Missa Mon cueur se recommande à vous. In this transcription and in the music examples discussed in the course of this study, methods are applied that derive from the new tendency to experiment with the barring of polyphonic music of the Middle Ages and the Renaissance. These experiments are based largely upon the principle that, since bar lines were not used in the sources, a falsification will necessarily result at times--indeed, often--if they are placed in the positions they would assume if used to indicate the "measures" denoted by the original mensuration signatures. Accordingly, attempts have been made to place bar lines where they are believed to be called for by the musical sense and by the text. Carried to the extreme, of course, this method could frequently lead to a different barring in each of the voice lines of a composition. In our examples, however, an attempt has been made to arrive at a uniform barring, except when this is virtually impossible.

Also included in the Appendix is an errata list that applies to all the modern published editions of those Monte parody Masses for which it has been possible to obtain reproductions of original sources.

Microfilm $4.40; Xerox $14.80. 342 pages.

THE BICINIA VARIORUM INSTRUMENTORUM OF JOHANN CHRISTOPH PEZEL. (VOLUMES I AND II).

(L. C. Card No. Mic 59-1761)

Arthur Loring Murphy, Ph.D.
The Florida State University, 1959

The works of Johann Christoph Pezel (1639-1694) have been almost completely neglected for well over two hundred and fifty years. His many contributions to the development of instrumental ensemble music receive little mention in music histories and relatively few exist in modern performing editions.

Pezel's music was written primarily to meet the cultural demands of the late seventeenth-century German city States, particularly for occasions of festive celebrations, for use in church services, and for use by music lovers in the home. Although the old German dance suite of the early seventeenth century with its austere polyphonic style furnished the immediate influence on Pezel's work, the newer resources and techniques of the last half of the century, especially those of the trio sonata and the solo sonata, are very much in evidence. In addition certain elements of the contemporary English and French styles are discernible. Many of Pezel's later ensemble works consist exclusively of one-movement compositions, free from characteristics of the dance, bearing the title of sonate. Such compositions exhibit many progressive devices of instrumentation and compositional techniques which offer important aspects of the late seventeenth-century orchestral style.

Little information is preserved regarding Pezel's life. He appeared first in Leipzig as a Kunstgeiger in 1664, became a Stadtpfeifer in 1669, and transferred his activities to Bautzen in 1681 where he remained until his death in 1694. During his lifetime he achieved considerable fame as a composer and clarino virtuoso, and his works remained in favor for some time after his death, often being performed along with those of Rosenmüller, Schein, and Kuhnau. Among his works are secular and sacred songs, several church cantatas, a mass, and nearly a dozen collections of instrumental works, although not all are extant.

The present study appears in two volumes, the first of which includes a biographical study of the composer, a brief discussion of all his extant works, and a stylistic analysis of the compositions in the Bicinia variorum instrumentorum. The music in volume two consists of seventy-two dances, thirty-eight sonatinas, and one sonata, all written for two solo instruments (violins, cornetti, clarini, bombardini, or fagotto) and continuo. The works are representative of the composer's middle period and were written during Pezel's eleventh year as civic musician in Leipzig. They are chamber works, dedicated to the merchants of Leipzig, and were intended to be performed in the home.

It is hoped that as a result of this study some new light has been focused on certain aspects of Pezel as a composer. While it is unlikely that his compositions ever again will become an important part of the daily lives of the people, a position they once enjoyed, there is sufficient charm, clarity, and simplicity of expression in much of Pezel's music to warrant present-day performance. Thus, it has been the intention of the author to present an edition which will make such performances possible, and through this work new interest may be kindled so that other of the composer's works may appear in modern edition in the not too distant future.

Microfilm $5.45; Xerox $19.00. 425 pages.

THE RAVENSCROFT PSALTER (1621): THE TUNES, WITH A BACKGROUND ON THOMAS RAVENSCROFT AND PSALM SINGING IN HIS TIME.

(L. C. Card No. Mic 59-1865)

William Paul Stroud, D.M.A.
University of Southern California, 1959

Chairman: Professor C. C. Hirt

It was to determine the source and to trace the metamorphosis of each tune, to examine the modality and harmonic structure, and to attempt to discover the name origins that this study was begun.

Psalms have been sung among individuals for as long as the art of religious song has been in practice. The so-called psalters of the 16th and 17th centuries were compiled from metrical translations of the Psalms which flourished in these years and were sung mainly in Calvinist churches. The practice continued into the 18th and 19th centuries. The singing of psalms continues today in services of certain churches. Among these are the Church of England and its American counterpart, the Protestant Episcopal Church. The new Service Book and Hymnal of the Lutheran Church in America, consisting of eight cooperating Lutheran bodies, employs the use of certain psalms to be sung in four voice parts in specific instances throughout its liturgical settings. Both Psalms 130 and 23 appear in the service for the Burial of the Dead. Psalm paraphrases and hymns based upon psalms are listed in the index of some current hymnals. The name of Ravenscroft still may be found as a source for certain of these settings.

Access to facilities of the Huntington Library and the Clark Library made the study of this period in history worth while and tantalizing. The loan of certain rare editions from such libraries as that of Princeton Theological Seminary and the microfilming of such institutions as the New York Public Library and the British Museum made available additional valuable material. Correspondence with various archivists and librarians in the United States and Great Britain provided information, inspiration, and firsthand sources for this study. The published work and personal correspondence of the Reverend Maurice Frost must be acknowledged. It was his English and Scottish Psalm and Hymnal Tunes ... that made easier the location of tunes in various psalters. This volume reached the University Library after the present study was begun and after

the expenditure of about one year in searching out and comparing the appearance and use of each particular tune as it was used in several psalters available at the Huntington Library.

The following method was used in compiling results of the study. Having consulted twenty-eight psalters firsthand and having located the tunes in these books which also appeared in the Ravenscroft psalter of 1621, the writer prepared tune work sheets and recorded other data for each of the ninety-seven distinct tunes found in the Ravenscroft.

Of the forty named tunes in this collection, twenty-three were found in no earlier psalter of those examined than the 1621 edition of Ravenscroft. Of these twenty-three, seventeen had been harmonized by the editor himself. This disproves the theory that these named tunes were original with the editor. It could be alleged safely that the names were affixed by Ravenscroft. Seventeen of the named tunes that were adopted from earlier sources were taken by Ravenscroft from Est's psalter of 1592, Daman's psalters of 1579 and 1591 and the Scottish psalters of 1561, 1564-65, and 1615. Of these seventeen, Ravenscroft harmonized eleven. Within the total collection of 179 pieces of music, the name of Ravenscroft was found with fifty-five. Some discrepancy occurred in two cases where printing problems resulted in the appearance of the name of Ravenscroft over two voice parts and that of Farmer over two others. This could imply perhaps that the two men had collaborated, but it is reasonably certain that collaboration did not take place.

The fifty-seven tunes classified as hymnes evangelicall, songs spiritual, and unnamed tunes were found to have been used in many collections prior to the 1621 publication of Thomas Ravenscroft. The alterations and innovations have been carefully studied and compared. It was found that Ravenscroft's volume made discreet use of innovations, preserved much of the original flavor within the tune itself, and was characterized by a uniformity that could make the volume especially popular among the amateurs.

The names of men of talent and distinction employed in the Ravenscroft collection distinguish this work from others. Such men as John Milton the elder, Morley, Farmer, Dowland, Allison, and Bennet add prestige to this collection. Testimonials and poetry offered in praise of Ravenscroft in the preface to his A Brief Discourse... by such men as Nathaniel Gyles, Thomas Campion, Thomas Piers, Martin Peerson, and John Dowland confirm his status. Subsequent to the Ravenscroft, some twenty-three prominent collections borrowed from or made reference to the 1621 publication. Beginning with The Bay Psalm Book of 1640, the list concluded with the impressive Canon Havergal edition of A reprint of all the tunes in Ravenscroft's book of psalms in 1845. The Episcopal Hymnal, 1940, credits at least two hymns to Thomas Ravenscroft. A man whose contribution to church music of his time, and whose influence through his works has continued somewhat to the present day, deserves more emphasis and merits a genuine revival to enhance the cultural and historical experiences of the contemporary church musician and layman. Microfilm $7.50; Xerox $25.80. 592 pages.

A PROPOSED MUSIC EDUCATION CURRICULUM FOR THE SMALL COLLEGE BASED ON A SURVEY OF CURRICULUMS IN SELECTED COLLEGES

(L. C. Card No. Mic 59-2433)

Anna Mae Terry, Ph.D.
Boston University Graduate School, 1959

Major Professor: Professor Jack Lemons

The purposes of the study were (1) to analyze and evaluate present practices in the education of school music teachers; (2) to discover any differences that might exist between large and small colleges; (3) to determine any advantages that might characterize the small college; (4) to propose a music education curriculum, in the light of data derived from a questionnaire and other sources, for a small college with enrollment up to 2,000 students.

Of the five hundred and twenty-five distributed questionnaires, two hundred and eight served as the source of primary data for this study. The responding institutions were classified as conservatories, liberal arts colleges, universities, and teachers colleges, located in forty-two states under both private and public control, and limited to enrollment of 2,000 students. Supplementary data were supplied through examination of one hundred catalogues; through conferences with thirty-five music educators and supervisors of public school music; and an informal inquiry sheet as to musical readiness in five hundred high school seniors.

The data from the questionnaire analyzed and evaluated in terms of the National Music Association, the American Association of Teachers Colleges, Music Educators National Conference, and Music Teachers National Association, were tabulated according to the main headings of the questionnaire. Appropriate tabulation and outline presentation were made of the supplementary data.

The proposed curriculum, including as an innovation, a special course in musical experiences and incorporating pertinent suggestions from all aforementioned sources and from the literature reviewed, was presented in outline form with explanatory tabulations.

FINDINGS AND IMPLICATIONS. School music teachers were being prepared in four types of institutions, however, a large majority were in liberal arts colleges under private control. Of the institutions reporting, there was apparently a growing recognition of the importance of accreditation. This was attested by the small number with no accreditation. The music education curriculums in these co-operating institutions, prevailingly followed a four-year or eight-semester period, but wide variation existed in semester hour requirements for graduation. It was also apparent that these institutions offering a major in music education were in agreement on requirement of high school units for entrance, nevertheless, indicated little use of objective tests or of screening by a special Music Committee.

Despite the fact that the basic music courses for developing musicianship received uniform approval by all institutions, wide variation existed in the amount of credit given in theory for graduation. As to the area of general culture, there was general agreement in all institutions as to the subjects included.

In the major performance area, the amount of credit given for piano and voice varied with that given for

orchestral and band instruments. The allotment of credit for these areas was lowest in teachers colleges. To a limited degree, all types of the co-operating institutions made provision for instruction in piano and voice classes. They also endorsed the special requirements (senior recitals and primary and secondary instruments) for music education majors.

Conducting, in the musical performance area, was generally accepted as an important required course by all institutions. Practice varied as to credit for ensembles and for group work on a laboratory basis.

Relative to student teaching readiness, there was a high degree of agreement among the institutions for considering as essential (1) screening candidates, (2) scholastic rating, (3) regularity of observation periods, and (4) completion of methods courses.

Microfilm $2.60; Xerox $9.00. 197 pages.

THE SACRED STYLE OF LUCA MARENZIO AS REPRESENTED IN HIS FOUR-PART MOTETS [with the] FIRST BOOK OF MOTETS FOR FOUR VOICES BY LUCA MARENZIO [as transcribed by the author]. (VOLUMES I AND II).

(L. C. Card No. Mic 59-231)

Walter Wilson Wade, Ph.D.
Northwestern University, 1958

Supervisor: Frank B. Cookson

This dissertation is a style study based on Marenzio's First Book of Four-Part Motets, the only published sacred music by Marenzio--excluding the youthful Sacri Concenti --which has survived. The study consists of an analysis of Marenzio's motets and a comparison of Marenzio's sacred style with Palestrina's.

The study is divided into two parts: the general survey and the comparative survey. The former describes the general characteristics of Marenzio's motets and cites the outstanding characteristics of his style. The latter consists of a comparison of Marenzio's and Palestrina's styles in respect to melodic material (general melodic style and text painting), harmonic material (general harmonic style, sequences, modal freedom, cross relations, and degree inflection), nonharmonic material, voice leading, and rhythmic factors.

The conclusions were as follows: Marenzio's sacred style is similar to Palestrina's style in most respects. Marenzio's motets are distinguished by their shorter phrases, more frequent and vivid text painting, deliberate use of sequences, greater frequency of accidentals, cross relations, modal freedom, degree inflection, and occasional voice leading and rhythmic freedoms.

A complete transcription of Marenzio's First Book of Four-Part Motets is appended.

Microfilm $4.05; Xerox $13.60. 313 pages.

PURCELL'S MUSICAL HERITAGE: A STUDY OF MUSICAL STYLES IN SEVENTEENTH CENTURY ENGLAND

(L. C. Card No. Mic 59-876)

Franklin B. Zimmerman, Ph.D.
University of Southern California, 1958

Chairman: Professor Raymond Kendall

Henry Purcell's musical style, like that of most of his English contemporaries, shows characteristics of the three main musical styles of the times. French, Italian, and, more important, older English music traditions established the basis for the new Restoration style, which found its fullest and most perfect expression in Purcell's works.

Each of these national traditions had been important much earlier in the history of English music. The influence of French music in England had begun at least as early as the time of the Norman invasion, and had continued from the times of jongleur and minestrier right through to the Restoration. In this latter period, the most influential French style in England was, no doubt, that of French opera, as exemplified in the works of Jean Baptiste Lully. Here Lully's instrumental style was especially important.

Italian musical styles were even more influential in the establishment of the Restoration style in England. The influence of these is particularly noticeable in the instrumental works of Purcell, who professed his admiration for Italian compositions in general, and singled out works by Monteverdi, Cazzati, and Lelio Colisto as models for some of his own compositions.

Again, the influence of Italian music in England may be traced back to earlier times. Perhaps the most influential form in this regard was the Italian madrigal. Emphasizing their native bent for abstract instrumental qualities, even in these vocal compositions, English composers succeeded in forging a very original idiom, even though openly imitating Italian models. Even so, features originally adapted for English usage from the Italian madrigal tradition may be traced in English music as late as the time of Purcell.

In the latter half of the seventeenth century, several Italian styles figured prominently on the English musical scene. Of these, the Catholic liturgical style, consistent with the ideals of the Counter-reformation, was one of the first to arrive, making its appearance in England slightly before the Restoration. Italian instrumental compositions from the early and middle years of the century were also important in England, as may be seen in some works by Jenkins, Locke, and Blow. Purcell openly confessed that he had followed Italian models in composing his trio-sonatas, and in formulating some of his theories of composition.

As was true of the history of French influence in England, opera served as the most important medium of Italian influence on music of the Restoration. Even though it was never to become genuinely successful, Italian opera was soon established as the predominant foreign musical activity in England in these times. The popularity of the Italian operatic style and the demand for Italian singers and instrumentalists were particularly important in the establishment of public concerts in England, which concerts were heavily indebted to Italy for their music as well as for their musicians.

These French and Italian styles exerted important formative influences on English Restoration music styles which, however, owed more to England's own musical traditions than to any from abroad. Even after the Commonwealth period, which had so seriously interrupted these traditions, features characteristic of earlier English instrumental, vocal, and dramatic styles reappeared with the Restoration to establish a style that was predominantly English, in spite of the several foreign styles that were involved in its establishment. Such recrudescences of English musical traits is especially noticeable in the works of Henry Purcell. Among his vocal works a penchant for harmonic acerbities—particularly those involving the augmented triad—and several madrigalian word-painting devices hark back to the composers of the English madrigal school. Purcell's familiarity with an older English idiom also manifests itself in his instrumental works. This is true not only in the Fantasias, In Nomines, and Pavans, but in the more Italianate sonatas and the so-called "French Overtures" as well.

A completely accurate appraisal of Purcell's importance in all of these developments is impossible as yet because of the scarcity of documentary and biographical data. Some of the disparities can be disposed of by re-evaluating evidence now available, but a thorough investigation of archives and documents will be necessary before any satisfactory results may be achieved. Purcell's identity is now certain, but many questions concerning his genealogy and his biography yet remain to be answered. The same may be said of his works, even though the Thematic Catalogue done in conjunction with this study provides an over-all survey of Purcell's oeuvre, and clarifies many problems which have remained obscure for want of this more detailed information.

Microfilm $5.95; Xerox $20.80. 467 pages.

PHARMACOLOGY

STUDIES ON MORPHINE TOLERANCE AND THE MECHANISM OF MORPHINE ACTION

(L. C. Card No. Mic 59-1864)

Robert Siminoff, Ph.D.
University of Southern California, 1959

Chairman: Professor Paul R. Saunders

1. Studies on Morphine Tolerance. The problem of tolerance to morphine in the rabbit was investigated, and it was found that tolerance could be produced to the respiratory depressant action of morphine. A dose of 20 milligrams of morphine per kilogram in the normal rabbit produced 90 per cent depression of respiration and in the tolerant rabbit produced no effect, although a typical response could be still elicited by giving a higher dose.

A method was developed for the determination of free and conjugated morphine which was at least five times more sensitive than the most sensitive method previously reported. The method consisted of the preparation of a trichloroacetic acid filtrate, acid hydrolysis for the conjugated fraction, and extraction of a strongly alkaline solution with n-butanol. The alcohol was extracted with sulfuric acid and the acid adjusted to a pH of 8.2 and extracted with sodium hydroxide. After esterification of the morphine with p-nitrobenzoyl chloride and concomitant extraction with ethylene dichloride, the morphine was determined by the methyl orange method. As little as 0.2 microgram per gram of tissue wet weight could be determined with a recovery of 100 per cent (S.D. ± 14 per cent); the tissue blank corresponded to 0.03 (S.D. ± 0.03) micrograms of morphine per gram of tissue.

The distribution of morphine (both free and conjugated) after an intraperitoneal dose of 20 milligrams per kilogram was studied in the normal and tolerant rabbit. The levels of free and conjugated morphine 0.5, 1, 2, 4, 8, and 24 hours after the administration of the drug was the same in both groups, in the blood, brain, liver, and kidney.

It was concluded that morphine tolerance was not due to altered drug distribution, metabolism, or excretion.

2. Studies on the Effect of Morphine on the Uptake and Utilization of Glucose by the Brain. Comparison of the ratio of glucose levels in the blood and brain in the normal and morphinized rabbits showed that morphine did not inhibit the uptake of glucose into the brain.

Physiological concentrations of morphine did not alter the uptake of glucose by incubated slices of cerebral cortex, brain stem, and cerebellum.

In other experiments under somewhat different conditions, physiological concentrations of morphine did not inhibit the uptake of glucose or oxygen, or the oxidation of glucose (as measured by the production of $C^{14}O_2$ from exogenous uniformly labeled glucose carbon^{14}) by cerebral cortex slices.

One hundred millimoles of potassium chloride stimulated glucose uptake, and oxidation and physiological concentrations of morphine did not inhibit this increased metabolism of glucose.

No evidence was obtained that depression of glucose metabolism is important in the mechanism of morphine action. Microfilm $2.00; Xerox $6.20. 128 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

THE PHILOSOPHY OF R. G. COLLINGWOOD

(L. C. Card No. Mic 59-2661)

William Debbins, Ph.D.
Syracuse University, 1959

This dissertation is a study in the history of philosophy: it is, essentially, a critical exposition and partial evaluation of the main principles of R. G. Collingwood's philosophy.

The first chapter contains a short biography of Collingwood and a brief discussion of his approach to philosophy. It is argued that, contrary to popular opinion, Collingwood was not a systematic philosopher but a problem-solver, deeply concerned with the autonomy of the special sciences and the problems which arise out of reflection on what the practitioners of these sciences do when they pursue their proper activities.

The second chapter presents a discussion of Collingwood's conception of philosophical method. It is maintained that certain methodological principles which are set forth in the Essay on Philosophical Method and the Autobiography are found implicit in all of his books: the question and answer logic, the differentiation between scientific and philosophical concepts, and the dual principle of the overlap of classes and the scale of forms. The chapter concludes with a discussion of Collingwood's conception of philosophy as a dialectical search for philosophical definitions and his attempt to establish a rapprochement between philosophy and history.

The third chapter presents Collingwood's definition of metaphysics as the science of absolute presuppositions. The logic of presuppositions is examined by presenting a concrete example of metaphysical analysis. The place of the Idea of Nature in Collingwood's philosophy is discussed and the view set forth that cosmology is essentially the uncovering of absolute presuppositions in the physical sciences by way of logical and historical analysis.

The fourth chapter examines Collingwood's definition of the nature and value of historical knowledge. The distinction is drawn between scissors-and-paste history and Collingwood's view of history as a science based on evidence. It is suggested that Collingwood's historical investigations were attempts to answer the questions: (1) How can we know what happened in the past, (2) how can we know why it happened, and (3) of what value is it for us to know what happened and why?

The fifth chapter explicates the definitions of man, society, civilization and barbarism found in the New Leviathan.

The conclusion presents a partial evaluation of Collingwood's contribution to philosophy. It is argued that many inconsistencies in his books can be explained if one recognizes that he wavered throughout his life between a form of Platonic-Hegelian idealism and historical relativism.

Microfilm $2.25; Xerox $7.80. 170 pages.

FAITH AND REASON IN THE THOUGHT OF ST. AUGUSTINE

(L. C. Card No. Mic 59-2665)

Gordon Russell Lewis, Ph.D.
Syracuse University, 1959

The purpose of this essay is to determine the contribution of St. Augustine of Hippo to a fundamental problem in the philosophy of religion, the relation of reason and faith. Among the central issues are the nature and autonomy of reason, the nature of faith and its relation to reason. Since Augustine has no extensive work correlating his views on the subject, it is necessary to systematize relevant materials from the miscellaneous primary sources. The paper is arranged logically or topically rather than chronologically since no major change in Augustine's position on the issues involved occurred during his period of literary productivity.

According to Augustine, one of two distinct types of reason is "intellectual cognizance" of eternal things resulting in wisdom (sapientia). The "eternal things" which reside in the Logos are forms of all particulars and plans for the succession of temporal events. The world is created and providentially sustained by the Logos in accordance with the immutable forms and purposes. Man, in the image of God, has a capacity for intuiting and contemplating the eternal forms and plans. By illumination the Logos conveys the content of the forms to all men through an inner spiritual suggestion. Hence man may realize immediate sapientia. On this interpretation Augustine teaches a qualified ontologism.

Although the eternal truths are always present, the intellect does not necessarily "see" them. Use of the intuitive capacity is contingent upon the will, the self-determining agency in every activity. But the will, by nature and habitual inclination, is characterized by an aversion to the Logos. The effects of this sin render the intuitive capacity blind to illumined truths. Aided by a grace of God common to the just and the unjust, man attains some immediate sapientia independently of faith. The highest manifestation of that attainment in Plato and Plotinus, however, does not discover the eternal purposes for the city of God.

Man's capacity for "rational cognizance" of temporal things which results in knowledge (scientia) is not affected by sin. The will has no aversion to particulars. Immediate knowledge of changing objects present to the individual may be achieved without faith. A man may have immediate knowledge of himself and of sensibles within the range of his past or present expérience. But knowledge of other selves and of history must be mediated through verbal or physical signs. Assent to the truth of such signs is faith. While the object of faith is unseen, its signs are seen and subject to critical examination. The Bible, as an alleged source of history, contains linguistic signs which are subjected to criticism. The Bible is found worthy of a

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

rational man's assent as a true source of mediated knowledge of the past.

Wisdom also is mediated in the verbal signs of the Bible. The verifiable evidence of fulfilled prophecy demonstrates that the inspired writers were able to anticipate God's purposes in history in a manner not possible to the most gifted intellects. Miraculous signs also attest the validity of the Bible as a source of mediated sapientia. On similar evidence the incarnate Christ is believed to mediate wisdom to man. Faith "on" Christ includes belief in His incarnation, death and resurrection, and commitment to His Person. Faith on Christ is prior to immediate intuition of otherwise unseen eternal purposes for upon the condition of that faith the Holy Spirit initiates a gradual conversion of the will and purification of the intellect. Then the doctrines of Christ and the Bible may become occasions of immediate intuition of God's purposes in history. Faith does not enslave man's intellect, but liberates and prepares it for the highest philosophical fulfillment.

Microfilm $3.10; Xerox $10.60. 239 pages.

COURNOT'S PROBABILISM

(L. C. Card No. Mic 59-2865)

Janevive Nadler Mechanic, Ph.D.
Columbia University, 1959

Although we all use probability statements successfully, there is no general agreement on the analysis (definition) of probability. Antoine Cournot (1801-1877) maintained that no univocal meaning could be given to the term 'probability'. Different meanings, depending on context are distinguishable. The purpose of this study is to clarify Cournot's concepts of probability, to determine the adequacy of his analysis and method, and to compare his ideas with some present day theories and applications.

There are two separate meanings of probability: first, "mathematical" probability, or the limit of relative frequency in the long run; and, second, "philosophic" probability, or degree of confirmation. Although probability statements are alike in these respects: a) each one is based on the assumption of uncertainties (chance factors) in the world, b) each one is a function of two arguments and asserts a probability statement with reference to supporting evidence, c) each is objectivistic in nature, nevertheless they differ in a) the sort of evidence regarded as relevant for the verification of probability statements, and b) the procedure of confirmation of such statements.

"Mathematical" probability is concerned with factual, empirical statements which refer to properties, kinds, or classes of things or events. It is applicable to statements colligating births, deaths, and scientific investigations, where evidential propositions are statistical in nature. Such statements must be distinguished from the theorems of the calculus of probability. Theorems do not state particular values of probabilities, but say something about connections between probability values. They are, thus, a branch of mathematics.

The procedure of confirmation is a resort to empirical trial: Suppose we wish to verify the statement: "The probability of casting an ace with this die is 1/6". A sufficiently long series of, say, n throws of the die in question must be made, and the number m of these throws which yields an ace counted. If the relative frequency m/n of aces in this series is sufficiently close to 1/6, the statement is regarded as confirmed.

"Philosophic" probability is concerned with assertions of logical relations between propositions describing events, states of affairs, or the like. It is applicable in cases where the statement to be confirmed is a scientific theory, a prediction concerning a particular single event, or an historic event, where evidential propositions are non-metrical. Questions at issue belong to inductive logic.

The procedure of confirmation: A scientist desiring to confirm a hypothesis h observes many particular events which he regards as relevant. After formulating this evidence in a report e, he tries to determine whether hypothesis h is confirmed by observational evidence e. The question of confirmation is answered by a logical analysis of h and e. It is not a question of facts, although the sentences h and e do refer to facts.

Cournot's contribution to probability theory is his attempt to give probability an objective meaning based on the nature of the problem at hand. When the term 'probability' is used in the context of statements about theories and historical facts, only the "philosophic" meaning is adequate. However, the "frequency" meaning is the most satisfactory when the term is used in the context of applied statistics and mathematics, as a comparison with Kolmogorov and Cramer reveals. In addition, the introduction of statistical methods into the physical sciences and the development of statistical mechanics has greatly strengthened the relative frequency concept of probability.

Microfilm $2.45; Xerox $8.60. 187 pages.

THE PROBLEM OF THE METHODOLOGICAL AUTONOMY OF HISTORY, WITH REFERENCE TO CERTAIN MODERN WESTERN THINKERS

(L. C. Card No. Mic 59-2618)

Elizabeth C. Wentworth, Ph.D.
University of Southern California, 1959

Chairman: Professor W. H. Werkmeister

This study is an exploration of the methodological relation between history and science. A section on historical background includes an examination of the theories of five writers of the past—Vico, Croce, Rickert, Adams, and Taine—who were selected as representative exponents of different points of view. In addition, some contemporary ideas are examined—especially in connection with the question of why philosophy of history is largely being neglected in recent American philosophy. Finally, a pragmatic way of approaching the main issue is presented.

Giambattisto Vico (17th century) made a gallant attempt to write a philosophy of history which should do justice to the various influences which were significant in the development of his thought—Christian truth, reverence for divine and natural law, and empiricism—in a view of history which presented the course of human events as occurring according to an ideal, eternal law. It is not clear to most commentators just how these diverse elements are reconciled; for this reason, interpretations of Vico's

philosophy of history vary widely, revealing how the later conflict over the issue of history versus science is foreshadowed in his work.

Benedetto Croce and Heinrich Rickert took the stand that history cannot be treated as a science. Croce based his assertion upon his thoroughgoing idealism and its accompanying epistemology. For him the distinction between history and science rests upon the nature of the concepts employed—history depending upon pure concepts, whereas science uses pseudo concepts. Rickert's analysis grew out of his neo-Kantianism. The historian deals with unique events which can be integrated only in terms of values, whereas the scientist is concerned with abstracting from particulars with a view to forming a value-free system of knowledge.

Hippolyte Taine and Brooks Adams represent the opposing point of view, both asserting that history can be treated as a science. According to Taine, history can best be studied through literature, by means of which the historian can come to understand the psychological anatomy of a people and the causes which operate to produce certain historical effects. Such a study results in knowledge of the laws which determine the different cultures of peoples. Adams, too, believed that a law of historical development can be ascertained, but he found the law to be analogous to the physical law of the conservation of energy.

In dealing with the problems of causality, relevance, and law in history, contemporary writers tend to fall into two main groups in their consideration of the question of the relation between history and science. One group consists of those who take an ontological approach, dealing primarily with the nature of the historical process itself; the other is composed of those who take an instrumental point of view, concentrating on the nature of historical explanation rather than on the nature of the historical process. Although both the claim that history is a science and the claim that it is not can be found within the two general categories of ontological and instrumental interests, the most popular opinions are either that history can be treated scientifically or that such treatment, although theoretically possible, is practically impossible. In view of the dominance of interest in philosophy of science in recent American philosophy, such opinions help to explain the neglect of philosophy of history. If history is scientific, even if only in theory, analysis of its problems is a subordinate part of the analysis of the methods of the sciences, and is relatively uninteresting until the methodological problems of the sciences have been fully explored.

It is suggested that some of the issues involved in the question of the relation between history and the sciences can best be treated from the instrumental point of view. A pragmatic theory of the nature of explanation is presented, whose main thesis in connection with history is that an explanation in terms of laws is not a satisfactory kind of explanation in a discipline which deals with human actions and purposes. Whether or not determinism is a fact, human beings feel as if they direct their actions, and they interpret the actions of others also in terms of conscious purposes. An intelligible historical explanation cannot be given in terms of the scientific concept of causality alone.

Microfilm $2.50; Xerox $8.80. 191 pages.

PHYSICS

PHYSICS, GENERAL

INFRARED ABSORPTION LAWS FOR SOME MINOR ATMOSPHERIC CONSTITUENTS

(L. C. Card No. Mic 59-2732)

Darrell Eugene Burch, Ph.D.
The Ohio State University, 1959

A study has been made of the infrared absorption bands of some minor atmospheric constituents. A knowledge of the absorption of these bands is important in interpreting spectra of the atmospheres of the earth and other planets, and in developing infrared detecting and guiding systems.

The total absorption of an absorption band is defined as $\int A(\nu)d\nu$, where $A(\nu)$ is the fractional absorption at frequency ν; and ν_1 and ν_2 are the frequency limits beyond which the absorption is negligible. This quantity is convenient to use in absorption studies because it can be shown to be independent of the effective slit width of the spectrometer, and depends only on the physical properties of the absorbing medium.

The present work involves a laboratory study of the total absorption of the 2224 cm^{-1} N_2O band, the 4260 and 2143 cm^{-1} CO bands, and the 1064 and 961 cm^{-1} CO_2 bands. Low resolution spectra of these bands are presented, as are tables of the measured total absorptions for the various values of absorber concentration w, absorber partial pressure p, total pressure P, and temperature T. Nitrogen, which does not absorb appreciably in the infrared, was used in the study of the N_2O and CO bands to increase the total pressure, which was varied from 1 to 3000 mm Hg.

For pressures between 10 and 760 mm Hg it is possible to express the total absorption as a function of the product wP_e^a, where P_e is found from a simple expression involving p and P, and the constant a has been determined experimentally for each band and is less than 1 in every case. For relatively small absorptions, the values of total absorption are given by an expression of the form

$$\int A(\nu)d\nu = k\,[wP_e^{\,a}]^b ,$$

where the constant b has been determined experimentally for each band, and lies between 0.5 and 0.6 for the N_2O and CO bands.

Larger values of total absorption are given by

$$\int A(\nu)d\nu = c_1 + c_2 \log (wP_e^{\,a}) ,$$

where the constants c_1 and c_2 have been determined for each band.

Results of the study of the N_2O and CO bands are

compared with predictions based on the so-called Elsasser band model, which is an idealized band consisting of equidistant absorption lines of equal intensity, each having the Lorentz shape. In general, the experimental results show a slightly greater dependence on absorber concentration and slightly less dependence on pressure than is predicted by the theory.

The 1064 cm^{-1} and 961 cm^{-1} CO_2 bands were studied at temperatures from 24 to 75°C and with total pressures between 100 and 3000 mm Hg. The total absorption of the CO_2 bands was found to increase slowly with increasing pressure but rapidly with increasing temperature. It is possible to estimate the increase in total absorption with temperature by assuming that the effective absorber concentration is proportional to the population of the lower energy level involved in the absorption process. The relative increase in the population of the energy level with temperature can be calculated from an equation based on a Boltzmann distribution.

Microfilm $2.00; Xerox $5.60. 111 pages.

PHOTOELECTROLUMINESCENCE, ELECTROLUMINESCENCE, AND RELATED HIGH FIELD EFFECTS IN ZINC SULFIDE PHOSPHOR LAYERS

(L. C. Card No. Mic 59-2925)

Dominic A. Cusano, Ph.D.
Rensselaer Polytechnic Institute, 1959

Supervisor: H. B. Huntington

Zinc sulfide phosphors have been produced in the form of continuous layers by a vapor reaction process. Electrodes have been applied to both surfaces, with metallic films producing contacts of a high-resistance or rectifying nature. A number of electro-optical effects have been observed by subjecting these phosphors to high d.c. fields ($> 5 \times 10^3$ v/cm) and bombarding them with ultraviolet, x-rays, or cathode rays. The present report contains a study of the main phenomena and an attempt to interpret them as general manifestations of the non-ohmic contacts and the semiconducting nature of luminescent zinc sulfide. The following grouping is helpful.

I. ZnS:Mn,Cl
   ZnS:Mn,X,Cl
   where X = P, As, or Sb
II. ZnS:X,Cl
III. ZnS:Cu,Cl

The preparation, structure, and various spectra of these phosphors are presented and discussed. All activator systems, with the exception of that due to Mn, are of the photoconducting type, i.e., optical excitation leads directly to the production of conduction electrons.

The effect most extensively treated is the steady-state enhancement of luminescence observed when group I phosphors are concurrently subjected to d.c. fields and 3650Å radiation. For an appreciable range in intensity, the energy content of the luminescent output is more than ten times greater than that of the incident radiation. The phenomenon, termed photoelectroluminescence, is primarily an ultraviolet control of electroluminescence. The incident photons modify the conduction electron density and the field distribution. The electric field is intensified on the cathode side of the phosphor via the positive space charge of ionized centers. Steady-state currents are produced which represent 10^2 to 10^3 electrons per incident ultraviolet photon. The light emission results from the deexcitation of localized manganese centers. These centers obtain the necessary excitation energy by direct collisions with accelerated electrons or by resonance transfer from electron-hole pairs created by accelerated electrons.

Brightness-voltage and current-voltage data are analyzed in considerable detail. Temperature and intensity dependences are discussed. The enhancement observed when x-rays or volume-penetrating cathode rays constitute the input radiation is essentially the same as that described for ultraviolet. D.c. electroluminescence, produced in the group I phosphors by a surface treatment, is seen also to involve collision-excitation of the manganese centers. Comparison between electroluminescence and photoelectroluminescence is made. A close agreement in terms of visible photons per conduction electron is observed and indicates that the collision-excitation mechanism is the same for both.

Steady-state enhancement with output-to-input energy ratios greater than unity is also observed in group II phosphors with high d.c. fields and 3650Å. Two photoconductive-type centers are necessary. One is the self-activated center and the other is the center attributed to P, As, or Sb. A high photosensitivity (10^4 to 10^5 electrons per incident photon) suggests a small electron capture cross section for the latter type of centers. Incident photons ionize both types of centers, but the self-activated ones preferentially capture electrons and tend to remain filled. The P, As, or Sb centers preferentially stay ionized and constitute the positive space charge. The self-activated centers are ionized by collisions with accelerated electrons in the high field region. Recombinations with slow electrons at these same centers constitute the main light emission.

Under irradiation, or subsequent to it, transient effects are observed when fields are applied or removed abruptly. These effects, which are seen with all the phosphors listed above, are described and interpreted. Experiments with two layer films of ZnS:Cu,Cl on ZnS:Mn,Cl demonstrate the importance of electron transport from one region of a phosphor to another. The transient suppressions of light output indicate the displacement of electrons from the photoconductive-type activator centers and the transient stimulations indicate the return of electrons to these centers. The origin and transport of the electrons is influenced by the incident intensity and the electron traps.

Microfilm $2.45; Xerox $8.60. 188 pages.

THE STOPPING POWERS OF METALS FOR PROTONS

(L. C. Card No. Mic 59-2719)

Donald Wayne Green, Ph.D.
The Ohio State University, 1954

Introduction

The dissertation is an account of the work done on two distinct problems which are related only by the fact that

both involve the use of the proton beam from the Ohio State University Van de Graaff generator. The first part is concerned with the design and construction of equipment for measuring the half-lives of short-lived radioisotopes and its use in determining the half-lives of Al^{25} and Al^{26}. The second part is concerned with the measurement of the stopping powers of the metals copper, silver, lead, selenium, bismuth, and tin for protons with energies from 400 to 1000 kev.

Half-Lives of Al^{25} and Al^{26}

Al^{25} and Al^{26} are unstable isotopes which decay with the emission of a positron leaving the stable nuclei Mg^{25} and Mg^{26}. There are few reports in the literature of measurements of the half-life of Al^{25}. Of these, the value of 7.3 seconds, obtained by Bradner and Gow,[1] is probably the most reliable. In contrast, there have been many measurements of the half-life of Al^{26}. Prior to 1948, these values seemed to center about 7.2 seconds, but recently Bradner and Gow[1] reported 6.3 seconds and Katz and Cameron[2] 6.5 seconds. The purpose of this investigation was to make an improvement on the half-life value and to try to find an explanation of the surprising discrepancies of the earlier determinations.

The basic problem of measuring the half-life of a given isotope quite naturally breaks up into two distinct subproblems. The first is to produce the isotope and the second is to provide a counting system suitable for arriving at a reliable half-life value. In the particular case of interest here, the isotope is produced by bombardment of natural magnesium with protons from a Van de Graaff generator. For Al^{26} the complete reaction as studied is $Mg^{25} + p \rightarrow Al^{26*} \rightarrow Al^{26} + h\nu$, with $Al^{26} \rightarrow Mg^{26} + \beta^+$.

Natural magnesium consists of 78.8 per cent Mg^{24}, 10.1 per cent Mg^{25}, and 11.1 per cent Mg^{26}. However, each of these isotopes enters into such a proton-gamma reaction only when the protons have certain energies corresponding to resonance levels of the isotope. By choosing a resonance level of Mg^{25} which is sufficiently far removed from any level in Mg^{24}, one is assured that the resulting activity is due to Al^{26} alone (Mg^{26} is of no concern here since the resulting Al^{27} is stable against positron decay). The two levels used in this work satisfied this requirement for Mg^{25}. They were the 563 kev level and the 720 kev level.

Since the half-life is short, it was convenient to keep the isotope inside the vacuum system at all times, and as a consequence it proved most practical to install the GM (Geiger-Mueller) tube, used to count the positrons emitted, inside the vacuum system also. The target was mounted on a slide which could be moved from a position in front of the beam of protons to a position next to the GM tube by means of an attached plunger which was actuated from the outside by a solenoid.

The signal from the GM tube was fed into a distributor which in turn transferred it to five scalers in sequence, each scaler counting for 3.6 seconds. Thus the first scaler always recorded the counts accumulated during the first 3.6 seconds after cessation of bombardment, the second scaler during the second period of 3.6 seconds, and so on. The sequence of operations was controlled by a timing shaft which was geared to the distributor so that the bombardment time, the interval between the end of bombardment and the beginning of the first period, and the interval between the end of the fifth period and the beginning of the next bombardment were the same for each complete cycle.

A half-life determination was made by repeating this cycle several hundred times. The total count accumulated by each scaler was then recorded, appropriate background corrections made, and the results plotted on semi-log paper (see Fig. 1). A straight line was drawn to make the best fit of the points and the half-life obtained from the slope of the line.

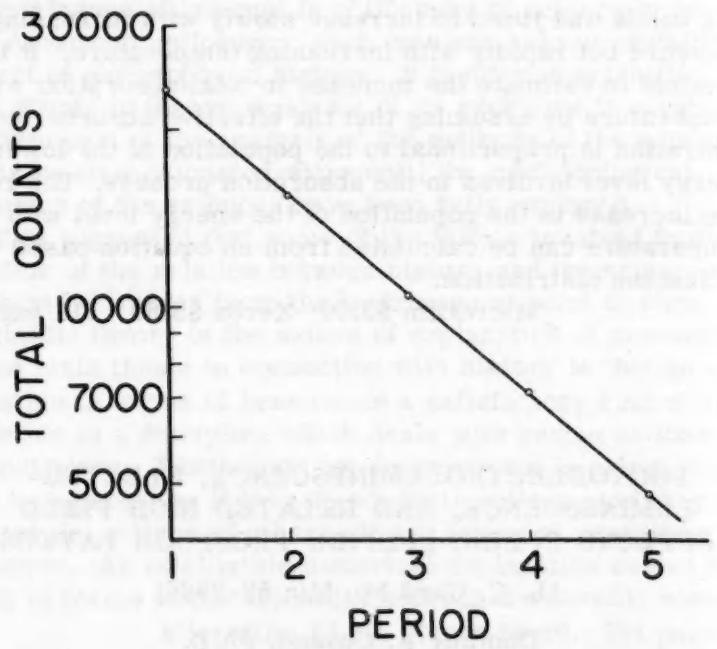


Fig. 1. — Plot of the data taken on the Mg^{25} 720 kev resonance. Half-life of Al^{26} read from the plot is 6.40 seconds.

In practice the most difficult problem was to determine the background with sufficient accuracy. It was observed that the background exhibited a decaying component, which indicated that one or more side reactions were being excited. One such reaction that was reasonably well established was $C^{12} + p \rightarrow N^{13}$, which emits a positron with a ten minute half-life and has a broad resonance at 460 kev. Carbon inevitably deposited on the surface of the target, so considerable activity from this source was noted. The only reliable method to determine the background was to reduce the energy of the protons about 15 kev below the resonance energy of the Mg^{25}. This reduced the activity from Al^{26} to a fraction of its peak value, but the side reaction activity was virtually unchanged since presumably it would not have a resonance peak at that energy. In taking a background the apparatus was operated in the same way as when taking data on a resonance. The time required for a background was generally greater than that necessary to obtain sufficient data on a resonance.

A determination of the half-life of Al^{25} was made to check the operation of the apparatus. The target was one prepared from the separated isotope Mg^{24}, and the level selected was the 825 kev resonance. The value obtained was 7.20 seconds, which is in good agreement with that reported by Bradner and Gow.

Two determinations were made on Al^{26}. The value at the 563 kev resonance was 6.47 seconds and the value at the 720 kev resonance was 6.40 seconds, which shows good consistency and excellent agreement with the more recent values already referred to. Unfortunately, no clear-cut reason for the consistently high values reported earlier is

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indicated by this work. It may be that these earlier determinations were plagued by background problems similar to ones encountered in this work.

The Stopping Powers of Metals for Protons

The energy loss of charged particles, such as protons and alpha particles, when passing through matter is mainly due to ionization and excitation of the atoms of the substance traversed. This topic is of great interest because of the information it gives about the nature of the interaction of charged particles with the atomic electrons and because of its use in such practical applications as shielding studies and nuclear emulsions.

The stopping power of a material is defined as the space rate of loss of energy suffered by a particle of nuclear dimensions in its passage through the material. In practice, the quantity actually measured is $\Delta E/\Delta x$, which is assigned to a particular energy E_{eff} (which for thin layers is the average energy of the particle during its passage through the material) since the stopping power is a function of the energy of the particle. For the sake of convenience, the units of ΔE are usually kev and the units of Δx are taken as mg/cm^2. If the stopping medium is composed of a single element, one can use the concept of atomic stopping power, defined as stopping power divided by the number of atoms per unit cube of the stopping material. This is sometimes called the "stopping cross section" of the atom. It may be considered as the average contribution of each atom of the elemental material toward slowing the incident particles.

The method used to measure the stopping power is one that was proposed by Madsen and Venkateswarlu[3] in 1948. A known thickness of the material is inserted into a beam of protons whose energy can be determined. The energy of the protons as they emerge from the foil is measured and the difference between the initial and final energies is the energy lost in the material. That, combined with the known thickness of the material, gives the stopping power.

In practice, the initial energy of the protons is determined from the analyzing magnet which serves to separate the protons from the other components of the beam produced in the Van de Graaff generator as well as to provide a method of measuring the energy of the protons. The final energy is determined with a target material such as lithium fluoride which has well-known resonance levels for proton-gamma reactions. In operation, the initial energy was gradually increased until the final energy was sufficient to excite one of these reactions. The initial energy was then obtained from the magnet current and the final energy was the proton energy known to be necessary to excite that particular resonance, thus giving the desired energy loss in the material.

The method of production of targets was to evaporate lithium fluoride, employed exclusively in this work as the target material, onto a target blank, and then to evaporate a coating of the stopping material on top of the lithium fluoride. The thickness of the stopping material was determined by weighing the targets before and after evaporation with a microbalance. This thickness was such that the energy loss was about 100 to 150 kev on the average.

Five resonances of lithium fluoride were used in this work: 340, 669, 873, and 935 kev resonances of fluorine and the 441 kev resonance of lithium. This produced five points from each target. Several targets of each material were run and a curve making the best fit of all the points was drawn. Table 1 gives the values read from these curves for the metals copper, silver, selenium, lead, bismuth, and tin. The standard deviations of most of the data average about 2.5 per cent, so the probable error is less than 2 per cent.

Table 1

Summary of Stopping Power Data

All Values Are Read from Drawn Curves

E kev	Δ E(kev)/mg/cm^2					
	Cu	Ag	Se	Pb	Bi	Sn
400	178	146.3	165	98	101	140
450	174.3	141.5	161.5	95.8	98.7	135.8
500	169	135.4	156.5	92	95	130
550	163	128.6	150.5	87.8	90.3	123.2
600	156.3	121.5	144	83.5	85	116.2
650	149.4	115.3	137.5	78.8	80.4	110.6
700	142	110	132	75.3	76.8	106
750	136	105.7	128	72.5	74.3	102.2
800	131	102.3	124.6	70.2	71.8	98.7
850	126.7	99	121.7	68	69.6	95.5
900	122.6	96	119	66	67.5	92.4
950	118.8	94	116.6	64	65.6	89.5
1000	115.2	92	114.2	62.3	63.7	86.7

In the 700 to 100 kev region the copper results agree with those obtained by A. B. Chilton[4] to about one per cent. They are about 6 per cent below the values reported by D. Kahn[5] and 10 per cent above those reported by C. B. Madsen.[6] In the lower energy region the curve from this work exhibits a hump rising about 7 per cent above Chilton's curve and then rejoining it at about 400 kev. This hump is not shown by any of the other reports. In the case of silver the results from this work are a very consistent 10 per cent above those reported by Madsen.

In 1952, Lindhard and Scharff[7] predicted that the atomic stopping power, σ, should be proportional to $Z^{1/2}$, where Z is the atomic number, for higher values of Z. To check this relation, the logarithm of σ was plotted against the

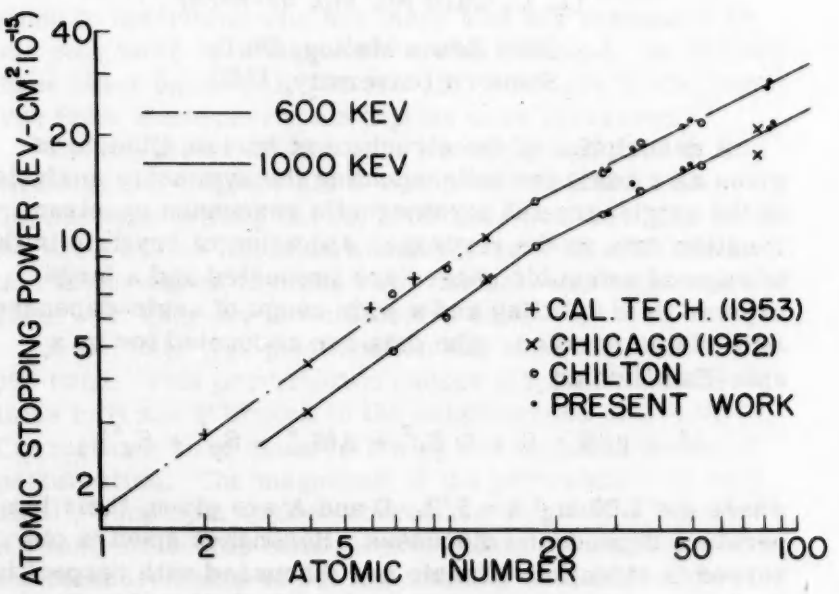


Fig. 2. — The Relation of Atomic Stopping Power to Atomic Number.

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logarithm of Z (See Fig. 2). Included in this plot are data from A. B. Chilton,[4] D. Kahn,[5] and the group at the California Institute of Technology.[8] In the event of duplication of measurements, those obtained in this laboratory were given preference. For the lower values of Z the points fall on a line with a slope of about 0.7, but at Z 18 the slope decreases to 0.5, which is in good agreement with the arguments of Lindhard and Scharff. The gold value from Kahn's work is the only point falling seriously off from the line; recent measurements in this laboratory indicate that his value is about 10 per cent low.

Microfilm $2.00; Xerox $5.40. 109 pages.

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Abstract published by special arrangement with The Ohio State University.

THE PARAMAGNETIC RESONANCE SPECTRUM IN SINGLE CRYSTALS OF BARIUM TITANATE

(L. C. Card No. Mic 59-2824)

John Edwin Maling, Ph.D.
Stanford University, 1959

A description of the structure of barium titanate is given as a basis for understanding the symmetry analysis of the single-crystal paramagnetic resonance spectrum. Rotation data on the resonance spectrum of crystals in the tetragonal and cubic phases are presented and a large crystal-field splitting and a wide range of angle-dependent line-widths is noted. The data are accounted for by a spin-Hamiltonian

$$\mathcal{H} = g\beta H \cdot S + D S_z^2 + A(S_x^4 + S_y^4 + S_z^4),$$

where g = 2.00 and S = 5/2. D and A are given, their temperature dependence discussed. Resonance spectra observed in strontium titanate are discussed with respect to the barium titanate spectrum. A perturbation theory analysis of the angular behavior of the strong-line spectrum is described and agreement with experiment is found. Absolute intensity is found by comparison with a gadolinium $^{+++}$ - glycerol spin-standard. An Fe^{+++} impurity, probably at a titanium site, is identified as the source of the spectrum.

The low-field spectrum at room temperature is described and experimental and theoretical evidence is presented showing the presence of energy "gaps" in the energy-level system where crossings occur. One gap cannot be explained by our theory. The implications of this are discussed. The resonance line-widths and their angular variation are discussed, attempting to relate this behavior to a distribution in the parameters D and A. The interpretation is successful and a distribution function is found. The detailed behavior and appearance of the gaps is shown in terms of this model. Finally, the implications of this distribution are discussed.

Experimental apparatus and techniques and miscellaneous experiments of interest are discussed in appendices.

Microfilm $2.00; Xerox $5.00. 96 pages.

FIRST ORDER PHASE TRANSITIONS OF SIX NORMAL PARAFFINS AT ELEVATED PRESSURES

(L. C. Card No. Mic 59-2906)

Rex Roland Nelson, Ph.D.
The Pennsylvania State University, 1959

First order phase transitions were investigated for the n-paraffins, n-nonane, n-dodecane, n-tridecane, n-pentadecane, n-octadecane, and n-tetracosane at pressures up to ten kilobars and temperatures up to 135.00° C. Correlations were made between the molecular length of these compounds and the thermodynamic parameters associated with their phase transition characteristics.

The experimentally determined quantities for each compound were the phase transition pressures corresponding to specific temperatures ranging from 15.56°C to 135.00°C at about 25°C intervals and the associated isothermal isobaric volume changes. For these determinations, a compound was enclosed within a lead capsule which in turn was suspended within a pressure-transmitting fluid. The high pressure isothermal compression and expansion of this aggregate was measured by a piezometric method. A phase transition in a compound at a particular temperature was apparent as a discontinuity in the compression and expansion curves of the aggregate, the magnitude of the discontinuity in the expansion curve corresponding to the volume change associated with the phase transition of the compound and the pressure value of this discontinuity corresponding to the phase transition pressure. Atmospheric pressure phase transition temperatures and the associated volume changes for n-dodecane, n-tridecane, n-pentadecane, and n-octadecane were determined using a dilatometer. In addition to the phase transition pressures and associated volume changes, corresponding changes in the entropy, internal energy, and enthalpy were obtained using the Clapeyron equation.

An analysis of the experimental results led to the following conclusions: (1) At a given pressure, the melting temperature of an odd n-paraffin is lower than that obtained by interpolation of the melting temperatures of the adjacent even n-paraffins. Further, this effect increases

with pressure and decreases with molecular weight. (2) The existence of solid phase transitions in a n-paraffin is apparently independent of molecular weight or of whether it is of even or odd species. (3) In general, the Simon-Glätzel equation does not describe the melting curves of n-paraffins. (4) At a given freezing pressure, but at different freezing temperatures, the liquid specific volumes of the n-paraffins are nearly the same. (5) At pressures where only one solid phase exists, the specific volume changes associated with the melting of the even n-paraffins are nearly the same for a given melting pressure even though the corresponding melting temperatures are entirely different. A similar statement appears to be true for the odd n-paraffins. (6) At the same melting pressure, the specific volume change in the odd n-paraffins is lower than that for the even ones, and this effect seems to increase with pressure. (7) At temperatures where only one solid phase exists, the enthalpy changes associated with melting, expressed in calories per gram, are nearly the same for all of the n-paraffins at the same melting temperature. (8) Superpression in n-paraffins, when observed, apparently increased with melting pressure. (9) The rate of a phase transition was nearly the same for liquid-solid and solid-solid transitions and was largely independent of the phase transition pressure.

Microfilm $2.00; Xerox $6.60. 139 pages.

MOMENTUM SPECTRUM AND POSITIVE EXCESS OF HIGH-ENERGY MU-MESONS

(L. C. Card No. Mic 59-2954)

Jerome Pine, Ph.D.
Cornell University, 1959

A magnet spectrometer has been used to measure the momentum spectrum and positive excess of μ-mesons vertically incident near sea level. The spectrometer utilized an electromagnet providing about 15 kilogauss in an 8″ air gap, between pole faces 45″ high and 22″ wide. Trays of geiger counters above, below, and centered in the magnet gap were used to record the passage of a particle through the spectrometer. In addition, immediately following the passage of a particle its momentum was electronically computed on the basis of the counters which were discharged.

The momentum range covered with good accuracy by the geiger counter method extended to about 10 Bev/c. For particles of higher momentum, three cloud chambers located near the counter trays were used to provide better resolution. The fast electronic computation of the particle momentum made it possible to trigger the chambers only on the highest momentum particles. The resolution attained with the cloud chambers led to a maximum measurable momentum of about 175 Bev/c.

The data obtained provide a measurement of the absolute differential momentum spectrum from 2 Bev/c to 115 Bev/c. Purely statistical uncertainties result in a standard deviation of ± 20% at the highest momentum, the statistical errors decreasing with decreasing momentum. An added uncertainty of about ± 10% in the absolute calibration is considered possible as a result of uncertainty regarding the effective aperture of the apparatus. From the data, the energy spectrum of pions at production has been calculated, assuming all muons to arise from pion decay. The result is a pion spectrum well represented by the expression $0.23\ (E)^{-2.64}$ sec^{-1} cm^{-2} $sterad^{-1}$ Bev^{-1} for pion energies from 10 to 150 Bev.

The differential μ-meson spectrum has been converted to an integral spectrum and compared with measurements of cosmic ray intensity underground by means of a conventional range-energy relation for μ-mesons. Reasonable agreement is obtained, which indicates that no important energy-loss mechanism has been overlooked.

The measurements made with the spectrometer also provide information about the muon positive excess, although the statistical accuracy is not high. From the positive excess data of this and other experiments, and from data on the spectrum of primary protons, a rough calculation has been made of some characteristics of high-energy proton interactions. The results indicate that such interactions must be characterized by both low multiplicity of pion production and low inelasticity. If the calculation is even roughly correct it indicates that the data are inconsistent with both the Fermi and Landau theories.

Microfilm $2.00; Xerox $4.60. 87 pages.

CORIOLIS PERTURBATION AND MOLECULAR CONSTANTS DERIVED FROM SOME INFRARED OCS BANDS

(L. C. Card No. Mic 59-2912)

Gopal Das Saksena, Ph.D.
The Pennsylvania State University, 1959

Extensive work on OCS (carbonyl sulphide) has been reported in both infrared and microwave regions. Microwave work has determined the rotational constants B and D for the ground state to a high precision[1] as well as yielding much information concerning resonating polyads of the form (v_1, v_2, v_3) and $v_1 \pm 1, v_2 \mp 2, v_3)$.[2,3,4] Results from infrared measurements[5,6] give conflicting opinion concerning resonances involving ν_3. Therefore it was proposed to make high precision measurements on the 002 and 003 bands to determine whether there was any resonance as was suggested by Thompson[5] for the 001 band. In addition three other bands 041, 301 and 221 which are in the region free from atmospheric absorption were measured.

The ten meter double-pass spectrograph used in this investigation employs a 8 x 4 inch Bausch and Lomb reflection type grating having 3000 lines per cm. The detector used was an Eastman Kodak Ektron PbS cell. To obtain better signal to noise ratio the cell was kept cooled at about -80° C in dry ice-cellosolve bath.

A Coriolis type perturbation has been observed in the 003 band. This perturbation causes displacement of few lines in R and P branch in the neighborhood of J = 30. Corrections were made following the standard theory of perturbation. The magnitude of the perturbation is very small; maximum applied correction was only 0.088 cm^{-1}. An analysis of this band already exists in literature,[6] but the measurements do not indicate any evidence of perturbation.

The band origins and rotational constants derived from measurements of the five bands are summarized as follows.

Band	ν_0	B′-B″	D′-D″ x 10^{-9}
002	4101.384	- 0.002424	- 1.15
041	4141.216	- 0.000032	+ 20.87
301	4609.842	- 0.002998	+ 0.34
221	4773.222	- 0.001493	+ 2.60
003	6117.572	- 0.003618	- 3.35

Assuming the ΔB value of 003 band is less precise in the light of the Coriolis perturbation, the best value of α_3 = .001212 cm^{-1} is obtained from 002 band. This value agrees very well with the microwave value α_3 = 0.001213 cm^{-1}. This agreement leads to the conclusion that there is no Fermi resonance in the 002 and 003 bands of OCS. The ΔB values for the other three bands cannot be compared with calculated values since these are members of known resonant polyads.

Microfilm $2.00; Xerox $3.00. 59 pages.

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MASS SPECTROSCOPIC DETERMINATION OF DIFFERENT IONS PRODUCED BY THE PROCESS OF PHOTOIONIZATION

(L. C. Card No. Mic 59-1862)

James Alexander Ross Samson, Ph.D.
University of Southern California, 1959

Chairman: Professor Weissler

The research area of photoionization in gases has been the subject of intensive efforts in a number of laboratories during the last ten years, which culminated in experimental measurements of photoionization cross sections in a representative number of gases and vapors. These cross sections were determined as a function of photon energy in the wavelength region between 2000A and 200A (6.2 ev and 62 ev) by employing techniques of vacuum spectroscopy. The stimulus for these investigations was provided by the need for data in such divergent fields as gaseous electronics, the physics of the upper atmosphere, astrophysics, and molecular physics. However, these photoionization cross sections, σ_i, referred to the sum-total of all ions produced by photons of a given wavelength. For example, in O_2 with λ = 600A both molecular and atomic ions are produced, hence, $\sigma_i = \sigma_i(O_2^+) + \sigma_i(O^+)$; but what fraction of σ_i led to the formation of O_2^+ (either in the ground state or in excited states) or of O^+ was not revealed by those measurements.

The present work concerns itself, therefore, with obtaining approximate values of photoionization cross sections by determining the identities and relative abundances of the ion fragments produced in a gas when irradiated by radiation below 1500A.

Results on photoionization in A, He, Ne, O_2, N_2, NO, CO, CO_2, N_2O, and NO_2 for the spectral region 460A to 1346A are presented. Identification of parent and fragment ions was achieved by combining a Seya type monochromator with a Nier type mass spectrometer. Graphs of ions per photon versus wavelength were obtained from which numerical values of ionization limits, dissociative ionization appearance potentials, and approximate photoionization cross sections were deduced.

First and higher ionization limits were obtained which, in general, agreed with spectroscopic values. However, since no higher ionization limits have been published for nitrogen dioxide, the appearance potentials at 11.3, 12.5, 13.4, 15.3, 16.2, 17.8, and 20.0 ev are held to be higher ionization limits of NO_2. The accuracy of these potentials is probably within 0.5 ev.

The appearance potentials of ion fragments were compared with potentials calculated from known dissociation energies. The results agreed well with the calculated values and also with electron impact data. However, in the case of the controversial dissociation energies of N_2, NO, and CO, the higher values of 9.76 ev, 6.49 ev, and 11.11 ev, respectively, were favored.

Photoionization cross-section measurements for fragment ions depend on their absolute abundance. Several factors make absolute ion intensity measurements difficult; in particular, ions created with kinetic energy were discriminated against in the ion source. No attempt was made to measure ion kinetic energies in this work. However, approximate photoionization cross sections for the fragment ions of O_2, N_2, and CO_2 were obtained. The cross sections for O^+ from O_2 and CO_2 at a wavelength of 630A were found to be 1.3 x 10^{-18} and 1.4 x 10^{-18} cms^2, respectively, while the photoionization cross section for N^+ obtained from N_2 was 0.2 x 10^{-18} cms^2 at a wavelength of 480A.

Microfilm $2.00; Xerox 4.80. 92 pages.

THEORETICAL AND EXPERIMENTAL TOTAL-ENERGY DISTRIBUTION OF FIELD EMITTED ELECTRONS

(L. C. Card No. Mic 59-2923)

Russell Dawson Young, Ph.D.
The Pennsylvania State University, 1959

Recent investigations of the energy distribution of field emitted electrons have resulted in an apparently excellent agreement between experiment and theory. The present investigation was initiated in order to employ the energy distribution measurement as a means of studying the electronic band structure in metals and semiconductors. Surprisingly, when the energy analyzer was improved in order to carry out this study, the measured energy distribution was much narrower than predicted by the existing normal-energy distribution theory. Further investigation revealed that the retarding potential energy analyzer which was employed measures the total electron energy rather than the energy associated with the component of velocity normal to the surface.

For the above reasons the Fowler-Nordheim equation has been derived in a new way in order to preserve the

distribution in total energy of field emitted electrons. A similar derivation has been carried out for thermionic emission. A striking mirror image symmetry has been found between the normal-energy thermionic emission and the total-energy field emission energy distributions. A similar symmetry has been noted between the total-energy thermionic and normal-energy field emission energy distributions. Further analysis indicated that the widths of the energy distributions in field- and thermionic emission are the same. This means that field emission and thermionic emission are now known to be on an equal footing in cases where energy distribution contributes to vacuum tube noise or to chromatic aberration in electron optics.

Energy distribution measurements at liquid hydrogen, liquid nitrogen and room temperatures were found to be in excellent agreement with the new theory. The resolution of the analyzer was 0.03 ev. Half-widths as narrow as 0.15 ev were measured and the temperature tail of the Fermi-distribution could be detected down to 77° K. A preliminary measurement of the total-energy distribution of thermionically emitted electrons was also carried out.

Microfilm $2.00; Xerox $3.00. 52 pages.

PHYSICS, ELECTRONICS AND ELECTRICITY

HIGH-POWER APPLICATIONS OF THE CONNECTED-RING STRUCTURE IN TRAVELING-WAVE TUBES

(L. C. Card No. Mic 59-2809)

Walter Revis Ayers, Ph.D.
Stanford University, 1959

Existing slow-wave circuits which are suitable for use in high peak or average power traveling-wave amplifiers tend to have considerably less bandwidth than that exhibited by low-power traveling-wave tubes. This study relates to two new circuit configurations which are suitable for use at high power levels and which have bandwidths greater than those exhibited by existing high-power circuits.

It is known that the cross-wound helix or connected-ring structure can be used at elevated beam voltages. In order to take advantage of the desirable high-voltage performance of this circuit for use in traveling-wave tubes of high average power capacity, it is necessary to devise a means of cooling the circuit without substantial deleterious modification of its properties. Two support configurations have been found which satisfy this need.

One of these circuits configurations comprises a connected-ring structure supported by metallic stubs. This stub-support was devised empirically to have the least harmful effect on the properties of the unsupported circuit. It was found by measuring the capacitative and inductive loading effect of a number of stub-support configurations which were successively modified to produce the desired result.

The final form of the stub-supported connected-ring structure which was devised would be particularly suitable for application in traveling-wave tubes operating in the 25-to-80 kv range, with peak powers between 50 kw and 1 Mw, and average powers between 4 and 10 kw at S-band. This is the power range for which existing tubes are least adequate. It is estimated that a megawatt peak power traveling-wave tube which made use of such a stub-supported connected-ring structure would have a small-signal bandwidth of more than 30 per cent. This is approximately three times the bandwidth exhibited by existing megawatt peak power tubes.

A second modified form of the connected-ring structure has been tested and is indicated to be suitable for CW operation. This form comprises a connected-ring structure supported inside ceramic disks. Tests on a circuit using alumina disks show that this circuit should be suitable for use in a traveling-wave tube yielding several kilowatts CW at S-band with more than 25 per cent small-signal bandwidth. A substantial improvement in the power handling capacity of this circuit could be achieved by using beryllia ceramic which has more than four times the thermal conductivity of alumina.

In order to conveniently evaluate these circuits a simple formula has been derived which predicts small-signal bandwidth from a knowledge of the dispersion and the impedance of the circuit. This formula, based on Pierce's small-signal theory, accurately relates the small-signal bandwidth of a traveling-wave tube to the parameters of the beam and the circuit at a single frequency. In the conventional formulation, the small-signal bandwidth is an implicit function of the measurable parameters of the system. This new formulation, being explicit, permits a direct determination of the effect of loading or of modifying the circuit.

Information is presented on techniques which are useful for measuring the properties of slow-wave circuits which possess the same symmetry character as the connected-ring structure. These techniques have application to a reasonably broad class of structures.

Microfilm $2.40; Xerox $8.40. 183 pages.

MULTIPHONON THERMAL DISSOCIATION OF EXCITONS IN POLAR CRYSTALS

(L. C. Card No. Mic 59-2628)

Ordean Silas Oen, Ph.D.
University of Missouri, 1959

Supervisor: Bernard Goodman

A method of calculating multiphonon dissociation of excitons and some numerical results are presented. In this work, the problem is defined and studied within the following framework: The exciton is represented by a two-particle hamiltonian consisting of an electron and hole. The lattice hamiltonian consists of the polar longitudinal modes, and a single vibrational frequency for them is used. The interaction between the exciton and the polar modes arises from the long-range dipole moments produced by the latter.

The initial wave function of the system is determined by the adiabatic method which provides a well-defined method for calculating a multiphonon transition probability. The translational symmetry of the crystal is handled by

applying a unitary transformation to the total hamiltonian which effectively displaces the origin of the polarization field to the center of mass of the exciton thus providing a "fixed" origin in order to use the adiabatic approximation. The dissociated state is taken to be a product of an electron polaron and a hole polaron. These polaron states are similar to those studied by Fulton who extended the Gurari and Lee, Low and Pines polaron to the case of intermediate temperatures. The overlap matrix elements of the oscillator states are handled by techniques similar to those developed and used by Huang and Rhys.

The main approximation in the above consisted of replacing the recoil term of the transformed hamiltonian by a "c" number when determining the initial wave function. The range of validity of this approximation is difficult to quantitatively assess, but it should be quite accurate if the total mass of the exciton is large.

The expression obtained for the thermal dissociation rate is similar to that found for trapped electrons by Huang and Rhys, but is more involved since the exciton coordinates appear along with the overlap matrix elements of the oscillator states. Numerical calculations are made for the case where the exciton radius is comparable with or larger than the polaron radius. The numerical results show the thermal dissociation rate can be approximately represented by an empirical equation of the form

$$W = Ce^{\frac{-Q}{kT}},$$

where Q is an activation energy. The present results are found to agree with the experimentally determined exciton lifetimes found in barium oxide by Phillip.

Microfilm $2.00; Xerox $4.80. 95 pages.

AXIAL ASTIGMATISM OF THE ELECTRON MICROSCOPE OBJECTIVE

(L. C. Card No. Mic 59-2566)

Robert Arnold Watkins, Ph.D.
The Ohio State University, 1953

The discrepancy of a factor of three between the theoretical resolving power of the electron microscope and that reported experimentally was first accounted for by Glaser[1] in terms of axial astigmatism on the basis of a geometric optical treatment. In a later paper, Hillier[2] presented a method of evaluating the magnitude of the astigmatism from the observation of the Fresnel fringes formed about the image of a small hole in a thin film, and a method of correction of the lens by the introduction of compensating iron screws in the pole piece assembly.

In the dissertation, the writer first determines the resultant image of a point source of electrons formed by an asymmetric lens from the stand point of wave mechanics. This theoretical consideration is then extended to the determination of the resultant electron distribution in the image of two self-luminous point sources in order to estimate the resolving power of a slightly astigmatic lens. These latter calculations lead to a theoretical upper limit of astigmatism which may be tolerated without affecting the resolving power as determined by contrast considerations and/or the third order aberrations.

Secondly, the writer presents a second method for the correction of the astigmatism in a magnetic lens. This consists of the introduction of an electrostatic cylindrical lens between the microscope objective lens and the image plane of this lens. This cylindrical lens can be oriented by mechanical rotation without the necessity of opening the evacuated microscope column, and its strength can be determined by the potentials applied to its electrodes. With such an arrangement, the correction of an astigmatic objective can be accomplished in minutes as compared to hours with the magnetic method of correction. Further, asymmetries introduced by the specimen can be corrected, and this is impossible with the magnetic system.

The calculation of the paraxial paths through an asymmetric magnetic lens whose field is considered to be of finite axial length indicates that there are formed in image space two mutually perpendicular focal lines. As a result, correction by an electrostatic cylindrical lens is possible. Further, from this result of geometric optics, it is possible to set up the approximate wave surface or surface of constant phase which corresponds to this case. The separation of this surface from the origin is given by

$$(1) \qquad r(\theta,\phi) = -R - \tfrac{1}{2}\sin^2\theta\left[D_1\cos^2\phi + D_2\sin^2\phi\right]$$

In this expression, the origin of coördinates lies at the intersection of the observation plane (the X,Y plane) and the optic axis (z axis); -R is the intersection of the surface with the optic axis; D_1 is the distance along the z axis between one of the focal lines and the observation plane; D_2 is the distance along the z axis between the plane containing the other focal line and the observation plane; θ is the angle formed by the ray and the optic axis (measured clockwise from the negative z axis); and ϕ is the angle between the X-Z plane and the plane containing the ray and the optic axis.

The intensity distribution in the image which is established by the electron lens must be determined from the Schroedinger Equation. However, image space is field free by hypothesis, and as a result, the Schroedinger Equation reduces to the wave equation in a region of constant index of refraction, where λ is the De Broglie wavelength, $\lambda = \frac{h}{\sqrt{2em\phi}}$.

Under the conditions of this problem, the Kirchhoff solution of the wave equation may be reduced to the form

$$(2)\psi = K\int_0^{\alpha}\int_0^{2\pi} e^{\frac{1}{2}ik\sin^2\theta(D_1\cos^2\phi+D_2\sin^2\phi)} e^{ik\rho\sin\theta\cos(\phi-\tau)}\sin\theta\, d\theta\, d\phi$$

where ρ and τ are the polar coördinates of the point of observation in the observation plane.

The evaluation of this integral is reduced to the evaluation of a series involving cosine and Bessel functions. For the particular case $D_1 = -D_2 = 2D$, that is, with the observation plane midway between planes containing the focal lines, the solution has the form

$$(3) \quad \psi = K'\alpha^2\sum_{n=0}^{\infty}(iDk\alpha^2)^n \sum_{j=0}^{\left[\frac{n}{2}\right]} \frac{(-1)^j 2^j(2n-2j)!}{(n-j)!\,(n-2j)!}\cos^{n-2j}2\tau \times \sum_{k=0}^{j}\frac{(-1)^k(n-j-k)!}{2^k k!\,(j-k)!\,(2n-2j-2k)!}\frac{J_{(2n+1-j-k)}(s)}{s^{j+k+1}}$$

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where $s = \alpha k \rho$. This result then indicates that the intensity distribution formed by an astigmatic lens is determined by the product $Dk\alpha^2 = C$. Thus the image intensity distribution is unchanged as long as the ratio of the product of the separation of the focal lines and the square of the aperture to the wavelength of the illumination is constant. Further, since the angle is small, $\sin \alpha \simeq \alpha$ and 2C is equal to the range of phase angles (in radians) encountered in the course of the integration.

The evaluation of this series has been carried out numerically for C=2 and C=3. The results of these calculations indicate that for these low values of C, the resulting diffraction patterns should be in the form of a four-pointed star with the points lying along lines parallel to the focal lines of geometric optics. That is, with an astigmatic lens there is no longer a sharply defined ring of zero intensity followed by a secondary maximum as is the case for a perfect lens. Instead, in the planes corresponding to those of the focal lines, a plateau is formed, and at an angle of 45^0 to these planes the intensity falls off more rapidly. Higher values of C were not considered because of the slowness of convergence of the series.

In an effort to estimate the resolving power of an astigmatic lens, the intensity pattern for two self-luminous points separated by the distance corresponding to s = 4 was computed for two cases: (1) the points lying along a focal line and (2) the points lying on a line at 45^0 to a focal line. In both cases a relative intensity minimum of about 80 per cent between the two intensity peaks corresponds well to the relative minimum of 75 per cent that is obtained with a perfect lens. On this basis, an astigmatic lens may be considered to be sufficiently corrected when its C value has been reduced to 2 or less. In the case of a typical electron microscope objective with an aperture of 0.005 radians and $k=1.17 \times 10^{10}$ (corresponding to an accelerating potential of about 50,000 volts), the permissible variation in focal lengths is .265 microns.

As a check of the validity of the calculations, a series of pictures was made with a cylindrical lens in combination with a spherical lens of greater strength to image a pinhole illuminated with a sodium vapor lamp. The resulting star shaped patterns for the cases C=2 and C=3 agree with those predicted theoretically. Further, a series of pictures were made with lens combinations and apertures to give values of C up to 13. This series of pictures show that the patterns pass through a transition regions for C's in the range 4 to 9. For still larger C's the pattern assumes the form of a distorted checkerboard, with the number of squares increasing with increasing C.

To reduce the astigmatism of a given objective lens to the permissible limit, a cylindrical electrostatic lens is proposed. This lens is shown schematically in Fig. 1. The lens consists of four electrodes, the outer two being at the potential of the microscope column and the center two being at a potential determined by the setting of the potentiometer across the power supply.

Since the electrodes and their associated spacers are mounted rigidly in the lens carriage, and the carriage is permitted no motion except one perpendicular to the slits (for centering) with respect to the mounting shell, rotation of the mounting shell about the objective pole piece coil assembly of the microscope results in a rotation of the slits.

The electrostatic lens has essentially no effect on the imaging in the plane parallel to the length of the slits, and

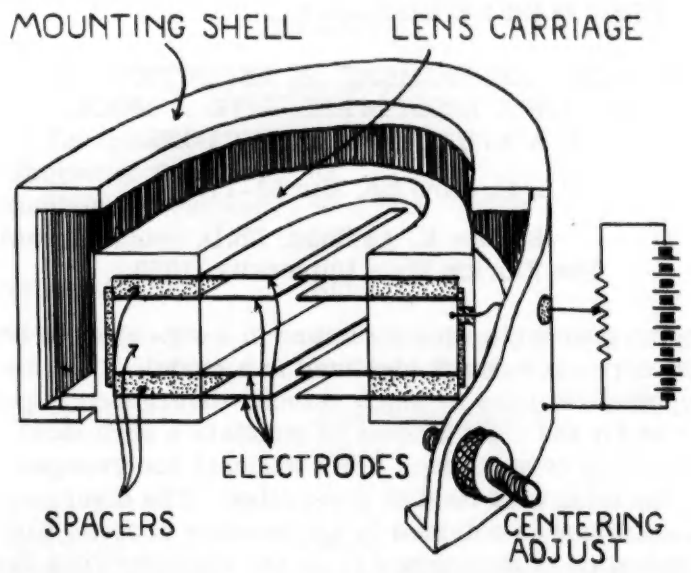


Fig. 1. — Schematic representation of the correcting electrostatic lens.

has a converging effect in the plane perpendicular to the slits which is greater or less according to the potential applied to the center electrodes.

The patterns calculated theoretically and verified by light optical methods have not been observed in electron micrographs because of the lack of a suitable specimen. However, the presence of astigmatism becomes evident in the Fresnel fringes formed about small holes in thin films. When the image is formed by an astigmatic lens, the focus may be adjusted so that the fringe coincides with the edge in one direction but is separated from a second edge at right angles to the first.

Making use of this phenomenon, correction can be accomplished by orienting the lens and increasing the potential applied to the center electrodes until the fringes about the hole are symmetrical. Both of these manipulations can be accomplished without opening the microscope column, and hence correction using this method proceeds rapidly. Also, the correction of asymmetries introduced by the specimen is possible.

It was found experimentally that a correction corresponding to a difference in focal lengths of five microns could be accomplished with the application of 2000 volts to the center electrodes with respect to the outer electrodes in the lens shown in Fig. 1.

Microfilm $2.00; Xerox $4.60. 90 pages.

1. Glaser, W. "Über elektronenoptische Abbildung bei gestörter Rotationssymmetrie," Z. Physik., 120 (Nov. 1942), pp. 1-15.

2. Hillier, J., and Ramberg, E. G. "The Magnetic Electron Microscope Objective: Contour Phenomena and the Attainment of High Resolving Power," J. Appl. Phys., 18 (Jan. 1947), pp. 48-71.

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PHYSICS, METEOROLOGY

A NUMERICAL EXPERIMENT IN DEDUCTION OF THE DIVERGENCE ASSOCIATED WITH A MODEL OF A STEADY COLD CYCLONE

(L. C. Card No. Mic 59-1755)

Stanley E. Asplund, Ph.D.
The Florida State University, 1959

The tropospheric wind structure in a sub-class of cut-off cold-core cyclones is idealized in a model. This model is a hypothetical case in which velocity divergence is present in exactly the right amount to maintain a zero local rate of change of vorticity. The rotational nondivergent part of the total wind field is prescribed. The divergent irrotational part is obtained by an iterative process based upon evaluation of divergence from the vorticity equation. Beginning with a lower-boundary assumption of vertical velocity, the divergence required to balance all other contributions to vorticity tendency is computed at 100 mb intervals. Successive pressure surfaces are linked by numerical integration of the continuity equation.

The model wind field is prescribed at a reference surface of 565 mb by mathematical expressions for zonal wind superimposed on a vortex. Each part of the wind field varies with height. At each pressure a given part has a fixed ratio to its value at the corresponding point of the reference surface. The observational basis and other considerations leading to selection of this model are discussed. The chosen model wind field is described by profiles of zonal and vortex wind speed on the reference surface, graphs of vertical variation functions, and implied vorticity distributions on the 500 mb and 900 mb pressure surfaces. Profiles and plan-view mappings of approximated distributions of geopotential are also shown.

Vertical motion at the 900 mb lower boundary is obtained as the result of convergence in the friction layer, using Ekman-spiral theory. The lateral boundary values of the divergent part of the wind field are assumed to be zero.

The vorticity and continuity equations in the (x, y, p, t) coordinate system are adapted to a finite-difference lattice established upon a selected Lambert Projection. The first approximation to divergence is that which balances the advection of vorticity by the model wind field. "Divergence-linked" effects are evaluated by a method of successive approximations devised for the purpose. Vertical motion values obtained by numerical integration of the continuity equation are used in computation of vertical-motion effects. The irrotational divergent wind field corresponding to approximated divergence is obtained by relaxation solution of Poisson-type equations.

Computations were carried out through the 500 mb surface. The following results are reported and discussed: the divergence required to balance advection of vorticity by the nondivergent wind, additional contributions by vertical-motion effects and divergent-wind advection of vorticity, vertical motion, and divergent wind. These are shown by tables and scalar analyses of plan-view and vertical cross-section distributions. The empirical evidence of the experiment in regard to the over-all iterative procedure is examined.

Results are interpreted in terms of success of the numerical process, indications of what is important in a model, and meteorological significance. It is concluded that further case studies and deductions of structure by numerical process, based upon this exploration, are feasible and can be expected to produce useful knowledge.

Microfilm $2.85; Xerox $9.80. 217 pages.

THE RELATIONSHIP BETWEEN THE TROPOSPHERE AND LOWER STRATOSPHERE

(L. C. Card No. Mic 59-2892)

Lowell Krawitz, Ph.D.
The Pennsylvania State University, 1959

The primary objects of the study were to establish statistical relationships between the stratosphere and the troposphere, and to derive means for inferring stratospheric flow from tropospheric conditions.

It is found that the 100 mb contour pattern is well represented by a 500 mb contour pattern space-smoothed over a 10^0 latitude square. The space-smoothed 500 mb chart is useful in determining the position of the polar vortex and in describing the direction and speed of the 100 mb geostrophic wind.

It is shown that the 100 mb and 500 mb contour heights are significantly correlated at all latitudes for several seasons. However, the slope of the regression line of 100 mb height on 500 mb height is a function of the scale of the systems involved.

Thirty-one spectra and cross-spectra of 500 mb and 100 mb contour patterns were computed. It was found that the polar regime is dominated by oscillations with periods of a month or greater which are related to the motions and intensifications of the polar vortex and to the seasonal variation of insolation in polar regions. The region outside of the polar regime is dominated down to middle latitudes by disturbances with periods of two weeks. Thus, the stratospheric regimes will be characterized by different 100-500 mb regression-line slopes.

The spectra of 100 mb and 500 mb height show little change from summer to summer in all regions, and from winter to winter outside of the polar regime. The spectra for the polar regime are vastly different from winter to winter. However, independent of stratospheric regime or season, the ratio of the high frequency to the low frequency energy is greater at 500 mb than at 100 mb.

Studies of 500-100 mb phase relationship showed that at all latitudes, 500 mb oscillations precede 100 mb oscillations by approximately one day. However, this should not be understood as a causal relationship.

Microfilm $2.00; Xerox $4.40. 83 pages.

PHYSICS, NUCLEAR

ASSOCIATED PRODUCTION CROSS SECTIONS BY PROTONS

(L. C. Card No. Mic 59-2461)

David Berley, Ph.D.
Cornell University, 1959

The investigation of heavy unstable particle production by protons in the Cosmotron range of energies was studied by observing gamma rays resulting from the decay of these particles at distances a few centimeters from the bombarded target. Relative gamma ray yields from several target nuclei have been measured when these nuclei were bombarded with 3 Bev protons. The data suggest that cascade processes play an important role in production processes in heavy nuclei. Estimates are made for total p-p and p-n associated production processes, which involve Λ^0 or Σ^0 hyperons, or K^0 mesons. The p-p section is significantly smaller than the p-n cross section. The ratio $\sigma_{p-p}/\sigma_{p-n}$ is less than 0.2 ± 0.3.

Microfilm $2.00; Xerox $4.00. 71 pages.

RADIOACTIVITY IN THE SAMARIUM REGION

(L. C. Card No. Mic 59-2546)

George Weirich Callendine, Jr., Ph.D.
The Ohio State University, 1954

INTRODUCTION

The samarium isotope of mass 145 is not found in stable form. It has been produced for several investigators by Sm^{144} (n,γ) reactions.[1,2,3] Sm^{145} is not available at the present time in complete isolation from all other isotopes. Therefore it is difficult to procure pure Sm^{145} to evaluate with finality the radiations and mode of decay. Separations have been made by mass spectrograph[4] and by the ion-exchange-resin method[1] to procure more definitive information. Table I lists the available information on Sm^{145}.

SOURCES OF ACTIVITY

Two enriched samples of Sm_2O_3 were secured from the AEC at Oak Ridge. The relative mass percentages of each stable isotope of Sm are indicated in Table II for natural Sm and for these two enrichments.

Two bombardments were made on the material. The short bombardment included two samples, one of each enrichment. These samples were sealed in quartz tubes and placed in the same stringer can. The material for the long bombardment was similarly prepared. Irradiation data are tabulated in Table III.

EXPERIMENTAL METHOD

After irradiation, small holes were ground in the quartz capsules and samples prepared from the various methods of analyses, which included:

1. Geiger Counting. — Relative activities, associated decays in activity, and absorption measurements with beryllium, aluminum, copper and lead were carried out with a mica-end window, soft-X-ray geiger counter.

2. Gamma Scintillation Spectrometer.[5] — A scintillation spectrometer employing a sodium-iodide (Tl activated) phosphor with RCA-5819 photomultiplier tube (resolution approximately 10 per cent at 661-k.e.v.) was utilized to analyze the gamma spectrum from the samples in more detail than is possible with absorption measurements.

3. 180° Beta Spectrometer.[6,7] — The beta spectra of the samples were analyzed in detail by two 180° spectrometers. Continuous electron emission spectra, conversion electrons and positrons were studied.

4. Dumond-Cauchois Type Curved Crystal Spectrographs.[8,9] — Curved crystal spectrographs were used to study quantitatively the flourescent and low energy gamma radiations of the Sm_2O_3 subjected to the long bombardment.

TABLE I

SAMARIUM-145

Nuclear Composition	
Z (Number of Protons)	62
N (Number of Neutrons)	83
A (Atomic Mass)	145
Per cent Abundance	None
Method of Production	Sm-n-gamma reaction Nuclear Reactor
Type of Decay	Electron Capture
Half Life	410
Radiations	
a. Particles	None
b. Electromagnetic	0.061 Gamma (K/L 1.0), Pm X-Radiation associated with electron capture process
Disintegration Scheme	None

TABLE II

MASS COMPOSITION OF NATURAL SAMARIUM AND TWO DIFFERENT ENRICHMENTS

Mass No.	Percent Abundances		
	Natural Samarium	Samarium Enriched in Sm^{144}	Samarium Enriched in Sm^{154}
144	3.16	58.93	0.034
147	15.07	13.46	0.362
148	11.27	5.31	0.361
149	13.84	3.19	1.70
150	7.47	1.39	1.20
152	26.63	3.77	4.25
154	22.53	13.95	92.10
Impurities Present		Si - .08% Y - 0.2%	Eu - 0.31 Cd - 0.15 Pt - 0.04 Y - 0.15
Total	99.97	100.10	100.65

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TABLE III

IRRADIATION FACTORS

	Short Bombardment	Long Bombardment
In Pile	3:00 P.M. April 23, 1953	November 24, 1953
Out of Pile	5:30 A.M. May 5, 1953	January 19, 1954
Total Hours Irradiation Time	273.5	1223
Neutron Flux (n/cm.^{2}/sec.)	2×10^{12}	2.6×10^{13}
Energy	Thermal	High (probably)
Sample	a. 20-mg. $Sm^2 O_3$ mass 144 enriched b. 100-mg. Sm_2O_3 mass 154 enriched	28-mg. $Sm_2 O_3$ mass 144 enriched

5. Wulf Unifiler Electrometer.[10] — The electromagnetic radiations were analyzed selectively from the charged particulate radiations with an electrometer utilizing a magnet between the source and chamber to sweep all primary and scattered charged particles from the region of the sensitive volume. Decay and absorption analyses were carried out.

RESULTS AND DISCUSSION

A. Mass-154 Enriched Sm_2O_3

Absorption data taken over a period of one year does not reveal the presence of a 1.7-year half-life (H.L.) as had been previously reported,[11,12] but rather an apparent 5-year H.L. The 1.7-year value was assigned to Eu^{155} (which originates from decay of the 23.5-m Sm^{155} formed from the $Sm^{154}(n,\gamma)$ reaction). This half-life was computed rather than experimentally observed, and the method of ratios used indicated Eu^{152} and Eu^{154} to have half-lives of 5.3-years and 5.4-years respectively. Subsequent investigations have changed these values to 13-years and 16-years. On the basis of the same ratio method, Eu^{155} should have a half-life of about 5-years, the value we are observing.

Absorption measurements indicate a gamma of 0.050-m.e.v. and one 0.500 to 1.4-m.e.v., and 1.3-m.e.v. and 0.47-m.e.v. beta particles decaying with this 5-year half-life, although these measurements are too short in duration to make definite assignments. Long lived gammas with 0.960-m.e.v. and 0.700-m.e.v. are observed by gamma scintillation spectrometer which are not duplicated in the mass-144 enriched Sm_2O_3 bombardment at the same time.

B. Mass-144 Enriched Sm_2O_3

1. Two Day Activity. — A low-energy gamma component is indicated from the base-line decay of the beryllium absorption curves. 700-k.e.v. beta particles are observed both from absorption and beta spectrometer measurements. On the basis of this information assignment of this 2-day activity to Sm^{153} appears reasonable, and this is in agreement with published information of the half-life and radiations of this isotope.[13]

2. Ten to Sixteen Day Activity. — Absorption and beta spectrometer measurements indicate a 2.1 to 2.4-m.e.v. beta particle decaying with 16-days. An average gamma energy of .500 to 1.0-m.e.v. is detected by Wulf electrometer and geiger counter absorptions, and gamma-scintillation spectrometer data indicates several energies of gammas decaying similarly. Nearest agreement with published information[13] leads to an assignment of Eu^{156}, although this would require a secondary reaction beginning with Sm^{154}, and the observed intensities as compared to Eu^{155} activity are higher than can be reasonably expected.

3. Twenty Five Day Activity. — Geiger-counter studies indicate a 45-k.e.v. gamma decaying with 25-days, although no 25-day period has been reported. High-energy gammas are also observed although no 25-day charged particles were detected.

Electrometer absorptions indicated a 37-k.e.v. gamma decaying with 25.6-days (probably the most accurate measurement). Curved crystal spectrograph films[14] indicated Sm and Pm X-rays, although no decay information is directly available with this method.

4. Four Hundred Day Activity. — 13-k.e.v., and 38-k.e.v. and 100-k.e.v. gamma rays are observed decaying with approximately one year half-lives. No particles are observed decaying with similar half-lives.

Butement[1] has reported a 410-day decay by detection of K and L X-rays of Pm from his Sm fraction which he attributed to Sm^{145}. The 38-k.e.v. gamma observed here by absorption methods agrees with this. In addition, the Pm X-rays recorded on the film of the spectrograph will probably decay with a similar period.

It appears that the Sm X-rays on the films must be associated with the 38-k.e.v. gamma detected by absorption measurements (both geiger counter and electrometer) to be decaying with 25-days.

On the basis of this information the 25-day activity appears to be the result of a transition from the metastable state to the ground state of Sm^{145} by emission of gammas which are totally or partially converted by ejection of orbital electrons. When the atom reduces its energy by rearrangement of orbital electrons, electromagnetic energy is given off (flourescent radiation) which is detected on the film as the Sm $K\alpha_1$, Sm $K_{\alpha 2}$, and Sm $K_{\beta 1}$ lines.

Upon reaching the ground state of Sm^{145}, further decay occurs by electron capture and subsequent rearrangement of orbital electrons with emission of flourescent radiations, this time characteristic of Pm since the electromagnetic emission must be subsequent to the capture of the electron by the Sm nucleus (which changes it to Pm). This process is the 410-day activity and is evidenced by the Pm X-rays recorded on the film and detected by absorptions.

Sm^{144} contains in its nucleus 62-protons and 82-neutrons. Thus, Sm^{144} has a nucleus with a "magic number" of neutrons. Adding a neutron to the nucleus to make Sm^{145} places the nucleus one neutron outside a closed shell. On the basis of the "Islands of Isomerism" as described by Feenberg and Hammack,[15] and others, an isomer at Sm^{145} would not be expected. However, a previous instance of an isomer of the same relative position has been described at Mo^{93} by Kundu, Hult and Pool.[16] This type of isomerism has been termed "Core Isomerism."[17] It appears from the

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data secured and here presented that another example of core isomerism may have been detected.

A further observation of the mode of decay of the Sm^{145} ground state is possible from the positron study. No positrons were detected at any period in the decay of the samples. It thus seems that the decay of Sm^{145} into Pm^{145} goes directly to the long-lived period, rather than to the 16-day isomer which is known to emit positrons.

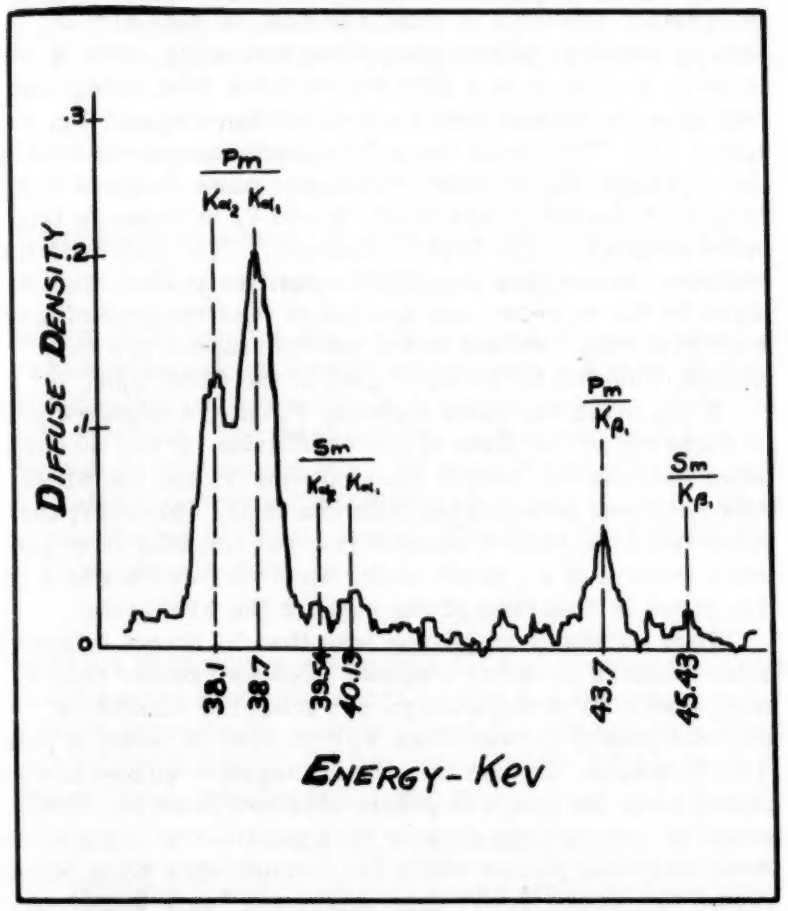


Figure 1. Photodensitometer Trace (Spectrogram) of Film Exposed on Curved Crystal Spectrograph Set for 40-Kev X-Rays. duPont Industrial Type-504 Film Used.

Measurement of Pm X-Rays

Hill, Church, and Mihelich[18] tabulate the critical-absorption energies for the elements. Values for Pm are interpolated because Element-61 is not present in naturally abundant form, and values were not previously measured. The Pm X-rays observed here may be used to calculate the actual values of these critical energies. When the assumption is made that the Pm K-energy is 45.2-k.e.v., as reported,[18] measurements from these data reveal the following:

L_{III} = 6.5 (± .1)-k.e.v.
L_{II} = 7.1 (± .1)-k.e.v.
M_{III} = 1.5 (± .2)-k.e.v.

Microfilm $2.00; Xerox $3.80. 70 pages.

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EQUIPMENT FOR STUDYING NUCLEAR DECAY SCHEMES AND RESULTS ON BROMINE AND NIOBIUM ISOTOPES

(L. C. Card No. Mic 59-2717)

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The Ohio State University, 1954

APPARATUS CONSTRUCTED FOR EXPERIMENTATION

The Beta Spectrometer

The beta-ray spectrometer used for the experimentation discussed in the dissertation was, with some modification, the one constructed by DeWire.[1] The changes were confined for the most part to the vacuum chamber and the current source.

A brass casing $5\frac{1}{2}''$ x 3″ in diameter was constructed to hold the Geiger-Meuller tube, which is an end-window beta-counter. The source consists of radioactive material deposited on a strip of thin cellophane or rubber hydrochloride. It is stretched across the prongs of an aluminum fork, which in turn is attached to the end of a brass tube, or "probe," passing through a Wilson seal to the outside of the evacuated region. A beryllium window was installed in the wall of the vacuum chamber in such a location that it is opposite to the source when the source is in the "full in" position. This window permits passage of low energy gamma-rays to regions outside the thick-walled vacuum chamber, and facilitates coincidence measurements between beta-rays and x-rays. The height of the slit system was increased because the intensity at the exit slit is proportional to the square of the slit height[2] for a given source strength. The current for the electromagnet was supplied by seven 6-volt storage batteries, which were charged during operation from a Tungar-rectifier charger. Condensers having a total capacity of about 40,000 mfds. were placed across the leads to the electromagnet coils in order to reduce ripple. The ripple thus obtained was only about 0.1 per cent, which was sufficiently below the resolution at which the instrument was usually operated, i.e., 1.5 per cent, to be negligible.

The operating constants for the spectrometer are given in Table I.

TABLE I

Operating Constants for the Spectrometer

Radius of curvature	16	cm.
Exit slit	3	mm.
Source width	1.5	mm.
Defining (central) slit	4.5	cm.
Slit height	2.7	cm.
Resolution	0.015	
Transmission	0.0015	
Operating pressure	$< 20.$	μ

The Coincidence Circuits

The circuit used for coincidence measurements on pulses obtained from G-M tubes consisted essentially of two pulse-shaping circuits, "univibrators," which fed pulses into a double triode 6J6 coincidence mixing tube. The univibrators shaped the pulses obtained from the G-M tubes into pulses of uniform height and a duration of one microsecond. The resolving time for the coincidence mixer was about 1.8 microseconds.

Single-Channel Pulse Analyzer

A single-channel pulse analyzer was designed by the writer for investigations on gamma-rays and nuclear disintegration schemes of weak sources. In this circuit, incoming negative pulses pass along two paths, each of which leads to a cathode of a 6H6 double diode tube, where the cathodes are biased positively to voltages V_1 and V_2, respectively. The incoming pulses must exceed the lowest of these biases, V_1, in order to trigger pulse shapers in the "register channel," and must exceed V_2 in order to trigger pulse shapers in the "cancel channel." The pulses in the register channel are inverted to positive pulses, then delayed by 0.3 microsecond and fed to the first grid of a 6BN6 multigrid tube. Pulses in the cancel channel are only shaped, then fed to the third grid of the 6BN6 tube.

If the incoming pulse exceeds V_1 only, a negative pulse is observed at the plate of the 6BN6 tube. If the incoming pulse exceeds V_2, then it also exceeds V_1 and the 6BN6 tube receives pulses from both channels. However, the pulse from the cancel channel reaches the tube first and takes control of it; hence under such circumstances a positive pulse is observed at the plate of the 6BN6 tube.

Thus pulses of amplitude less than V_1 do not trigger the pulse shapers in either channel. Pulses greater than V_1 only, give rise to negative pulses from the 6BN6 tube, whereas pulses greater than V_2 give rise to positive pulses from this tube. By use of a diode, negative pulses are separated from the positive pulses obtained from the 6BN6; hence by counting the former it is possible to register only those incoming pulses which have amplitudes lying between V_1 and V_2, where $V_2 - V_1$ determines the "gate width" of the analyzer. The bias V_1 can be adjusted to any desired value between zero and 100 volts, whereas the gate width is kept fixed by use of a battery.

MEASUREMENT OF THE CYCLOTRON ION BEAM

A new method for measuring the ion-beam current in the Ohio State University cyclotron has been developed. This method consists of measuring the absolute thick-target yield of activity obtained for a known nuclear reaction and comparing it with the yield which would be expected on the basis of the excitation function for the reaction, the unit ion current, and the energy of the accelerated ions. The measurement of the absolute source strength of a target material after it has been bombarded in the cyclotron was achieved by use of the coincidence method. For the application of this method it is essential that the disintegration scheme for the radioisotope produced be known.

The radioisotopes chosen for these measurements were Na^{24}, Co^{60}, and Au^{198}. The activated target material was placed between two end-window G-M tubes, and observations were made on the beta-gamma and gamma-gamma coincidence rates as well as the single beta or gamma count rates. From these measurements, the absolute source strength was calculated by the method outlined by J. V. Dunworth.[3]

In order to calculate what the activity of the target

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material should be for an incident beam of one microampere and known excitation function, the following considerations must be taken into account:

- $\sigma(\bar{E})$ average cross section for reaction when energy of incident particles is between E and E + dE, as obtained from the excitation function
- $\bar{E}$ average energy of the bombarding particles in traversing a thickness dx of target
- n total number of particles incident on the target during bombardment
- N number of atoms per square centimeter of target foil
- dN^* number of atoms activated in thickness dx of target material

$$dN^* = Nn\,\sigma(\bar{E})dE/(dE/dx)$$

Then the total number of activated atoms produced is

$$N^* = Nn\,\sigma(\bar{E})\;\delta x(\bar{E})$$

where $\delta x(\bar{E})$ denotes the finite interval of range which corresponds to a fixed loss of energy (say 0.5 Mev) of the bombarding particles having average energy $\bar{E}$ in that finite interval. The total activity is thus obtained by numerically integrating over the products of $\sigma(\bar{E})$ and $\delta x(\bar{E})$ at equal successive increments of energy up to the (maximum) energy of the ion beam. The thick-target yield, dN^*/dt, then is given by

$$dN^*/dt = \lambda N^*$$

where λ is the decay constant. If "Q_0" denotes the calculated source strength, and "Q_0'" denotes the measured source strength for a thick target after it has been bombarded for T hours; the average current "i" for the ion beam during bombardment will be

$$i = Q_0'/Q_0 T \text{ microamps.}$$

In Table II are given the results obtained from six bombardments.

TABLE II

Results Obtained for Measurements on the Cyclotron Ion Beam

Bombardment Number	Target	Yield		Beam Current (μ amp)
		Measured (mc/hr)	Calculated (mc/μ amp-hr)	
1	Co	1.10 (± 0.04)x10^{-3}	0.49x10^{-3}	2.35(± 0.09)
2	Au	8.5 (± 0.4)	2.7	3.15(± 0.15)
3	Au	7.37 (± 0.35)	2.7	3.00(± 0.16)
4	Co	1.34 (± 0.05)	0.49	2.74(± 0.10)
5	Au	(± 0.10)	2.7	1.51(± 0.07)
6	Na	0(± 0.22)	6,000	1.42(± 0.04)

As a confirmation of the above method, the calculated values for the thick target yields of the different target materials used were compared with values measured elsewhere for different energies of the deuterons. The latter values were obtained at Oak Ridge and at the University of California. Reasonably good agreement was obtained between calculated and published values.

RADIOISOTOPES OF BROMINE

Radiations from several radioisotopes of bromine have been studied by use of the beta-ray spectrometer and by absorption and coincidence measurements. The radioisotopes were obtained by proton and deuteron bombardments on selenium metal. Decay of their activities was followed with the aid of a Wulf electrometer attached to an ionization chamber filled with freon to a pressure of about 2 atmospheres. In addition a magnetic field was used to separate positrons from negatrons, thus enabling decays of the activities giving rise to these particles to be determined separately by use of a G-M counter. Two types of samples of selenium metal were bombarded with protons of 7.3-Mev energy. One type contained the natural isotopic mixture of stable selenium isotopes, and the other type contained Se^{76} enriched from 9.0 to 41.5 per cent. In addition to the well-known bromine activities, a new activity of 17.2 hours half-life was observed. Some evidence for the existence of a 15.7-hour activity had been observed previously by Hopkins,[4] and a 16.5-hour activity was subsequently obtained by Hollander[5] when arsenic was bombarded with alpha-particles. The results for the work discussed below have been previously reported.[6]

Decay curves were obtained for each type of selenium metal target which was bombarded. The curves were analyzed and the relative contributions to the total activity at the time corresponding to the beginning of the measurements were found for each component activity. Decay curves for the positrons and x-rays were also followed.

In Table III are given activity data for the various isotopes present in the activated samples obtained from three

TABLE III

Percent Abundances and Intensities

Mass Number	82	80	78	77	76	74	
	Percent Abundance						
Enriched Se	5.0	30.2	16.1	6.8	41.5	0.5	
Natural Se	9.2	49.8	23.5	7.58	9.02	0.87	
Activities	Br^{82} 1.46 days	Br^{80} 4.4 hrs.		Br^{77} 2.4 days			17.2 hrs.
	Intensity of Activity in Arbitrary Units						
Enriched Se	5.8	482	.....	7.94	.....	.....	37.4
Natural Se (no chem.)	9.2	710	.....	10.1	.....	.....	9.9
Natural Se (chem.)	9.2	872	.....	.....	.....	.....	8.3

bombardments. The bottom row contains activities obtained when the bromine was chemically separated from the selenium metal. The activity values listed have been adjusted to take into account differences in the cyclotron beam during the separate bombardments. In making these adjustments the 36-hour Br^{82} activity was chosen as a reference standard and the adjustment was made by equating the 36-hour activity to the isotopic abundance of Se^{82} for each type of sample bombarded. Examination of the relative change in 17.2-hour activity with change in isotopic abundance shows that this activity arises from the isotope Se^{76} by bombardment with protons.

Radiations from the various bromine isotopes obtained were further examined by use of the spectrometer and coincidence measurements. The results of such measurements are given in Table IV.

The negatron spectra of Br^{80} had previously been

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TABLE IV

Summary of Data Obtained on Radiations From Bromine Isotopes

Isotope	Radiations Examined	Partial Spectra (Mev)	Partial Spectra Percent	log(ft)	Gamma-Rays (Mev)	Coincidence Results
Br^{78}	negatrons	1.70 ± 0.02 0.8 0.6 0.3	46 20 15 19	5.6 4.9 4.7 4.7		
Br^{76}	positrons x-rays γ-rays	3.57 ± 0.07 1.7 1.1 0.8 0.6	46 10 11 14 19	7.85 7.1 6.5 6.1 5.8	0.25, 0.33 0.37, 0.42 0.68, 0.75 0.96, 1.21	3.57 Mev positrons to ground state of Se^{76}
Br^{77}	positrons x-rays γ-rays	0.70			0.160, 0.234 0.299, 0.521	positrons to ground state of Se^{77}
Br^{80}	negatrons	1.97 ± 0.03 1.1 0.7	80 11 9	5.48 5.3 4.7		1.97 Mev negatrons to ground state of Kr^{80}
Br^{83}	negatrons	0.94 ± 0.02	100			

classified at first as forbidden,[7,8] but the above data, according to more recent classification of the log(ft) values,[9,10] show that they fall into allowed groups. The ground state configuration for Br^{80} is seen to be $p_{3/2} - p_{1/2}$.[10,11,12] The same configuration applies to the ground state of Br^{76}, but the log(ft) values are higher than for the allowed groups, although the spectra have allowed shapes. This might be explained by attributing the 17.2-hour half-life to an isomeric level, as in the case of the 4.4-hour half-life of Br^{80}.[13]

RADIATIONS FROM NIOBIUM 96

Radioisotope Nb^{96} decays by negatron emission to Mo^{96}, with emission of gamma-rays. Some investigations on this isotope have already been made.[14,15] Preiswerk[16] reported two partial beta-spectra with end-point energies and abundances of 0.75 Mev (92 per cent) and 0.37 Mev (8 per cent), and gamma-rays having energies of 1.187, 1.078, 0.770, 0.560, 0.451, and 0.216 Mev with internal conversion coefficients of 3.1, 5.6, 12.0, 16.5, 40, and < 230 in units of 10^{-4}, respectively.

For the work discussed below, ZrO_2, in which the Zr was enriched from 2.8 to 74.6 per cent, was bombarded with 6.3 Mev protons to obtain Nb^{96} by (p,n) reaction. The radiations of the latter were examined by use of the instruments previously discussed. In Table V is given a summary of measurements obtained on gamma-rays when examined by use of uranium and lead radiators in the beta spectrometer and by the scintillation spectrometer.

The contribution which each gamma-ray makes to the total gamma energy emitted per distintegration is the product of the probability per disintegration for emission of the gamma-ray (intensity, p) and the quantum energy of the gamma-ray. The total gamma energy emitted per disintegration is the sum of these products taken for all gamma-rays emitted by Nb^{96}. This was found to be 2.42 ± 0.53 Mev.

The total gamma-energy emitted per disintegration was measured by the coincidence method. This was done by first measuring the quantum efficiency of the gamma counter by means of gamma-rays from Co^{60}, Co^{58}, and Sc^{44}, then measuring its efficiency for the gamma-rays of Nb^{96}. The measurements yielded a value of 2.25 ± 0.15 Mev,

TABLE V

Energies (in Mev), Intensities, and Internal Conversion Coefficients of the Gamma-Rays From Nb^{96}

U Photopeaks	Pb Photopeaks	Scintillation Spectrometer	Average γ-Energy	Internal Conversion	Intensity, p
.....	0.078	0.070	0.074	.....	.....
0.175	.170	.165	.170	$4.8x10^{-2}$	0.0283
.216	.211	.208	.214	$5.0x10^{-2}$	.0326
.241	.234	.....	.238	$3.1x10^{-2}$	.0340
.318	.....	.323	.320	.....	.0264
.455	.....	.440	.455	$4.9x10^{-3}$	.3100
.556	.....	.530	.556	.....	.3720
.773	.768	.747	.773	$1.3x10^{-3}$	1.000
.801	.....	.840	.801	.....	.173
.846	.....	.840	.846	$8.4x10^{-4}$	.262
1.018	.....	1.040	1.018	.....	.157
1.085	.....	1.060	1.085	$8.4x10^{-4}$	.320
1.185	.....	1.160	1.185	$4.5x10^{-4}$	.344

which agrees with the spectrometer measurements. Coincidence-absorption measurements were made whereby the scintillation spectrometer was used to select one of the gamma-rays, and beta- or gamma-rays in coincidence with this gamma-ray were examined by a G-M counter. The results of all coincidence measurements are in agreement with the disintegration scheme proposed by Preiswerk.[16] Microfilm $2.00; Xerox $4.40. 84 pages.

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Abstract published by special arrangement with The Ohio State University.

DECAY SCHEMES OF Ge^{68}, Ga^{68}, Cu^{66} AND As^{74} AND SYSTEMATIC TRENDS OF EVEN-EVEN NUCLEI IN THE REGION $28 < N < 50$

(L. C. Card No. Mic 59-2820)

Daniel Joseph Horen, Ph.D.
Stanford University, 1959

The decays of Ge^{68} (275 day), Ga^{68} (68 minute), Cu^{66} (5.1 minute), and As^{74} (17.5 day) have been reinvestigated with single and coincidence scintillation spectrometers, and a search has been made for systematic trends in the characteristics of even-even nuclei in the region $28 < N < 50$.

Comparison of the Ge^{68} and Ga^{68} singles spectra indicates that Ge^{68} decays solely by electron capture to the ground state of Ga^{68}. In addition to the known annihilation quanta and a gamma ray of 1.07 Mev in the decay of Ga^{68}, gamma rays of 0.81 ± 0.02, 1.24 ± 0.02, and 1.88 ± 0.02 Mev are observed. A level scheme of Zn^{68} with levels at 1.07, 1.88, and 2.31 Mev is proposed.

In the decay of Cu^{66}, a (0.83 ± 0.01)-Mev gamma ray has been found to be in coincidence with the previously known 1.04-Mev gamma ray arising from the decay of the first excited state in Zn^{66}. This indicates a (second) excited state in Zn^{66} at 1.87 Mev.

The singles spectrum of As^{74} revealed previously unknown gamma rays of 1.19 ± 0.01, 1.60 ± 0.04, and 2.22 ± 0.02 Mev. X-ray--gamma-ray coincidence measurements indicate that the 1.19-Mev gamma ray is predominantly associated with the decay to Ge^{74}. Evidence is found for (0.6-0.6)-Mev gamma-gamma coincidences in Ge^{74}. Based on these data, a level scheme for Ge^{74} is presented with excited states at 0.596, 1.19, and 2.22 Mev. No new information concerning the decay to Se^{74} has been gained.

The ratio of the energy of the second excited state to that of the first excited state, E_2/E_1, appears to be less than 2 for those nuclei where $28 < N \leq 40$ (N = neutron number), and greater than 2 where $42 \leq N < 50$, when the proton number is ≥ 28. (The 0^+ levels in Ge^{70} and Ge^{72} are neglected in this consideration.) For a given element, the E_2/E_1 versus N plot exhibits dips at those isotopes which possess closed shell or subshell neutron configurations, i.e., N = 28, 32, 38, or 40. Qualitatively, the data suggest that the even-even nuclei in this region describe near-harmonic vibrations, at least as far as the first two excited states are concerned.

Microfilm $2.10; Xerox $7.40. 157 pages.

PHOTOPRODUCTION OF CHARGED PION PAIRS IN HYDROGEN

(L. C. Card No. Mic 59-2955)

John Michael Sellen, Jr., Ph.D.
Cornell University, 1959

The reaction which is of interest in this study is the production of charged π meson pairs by γ-rays which are incident upon protons, i.e.

$$\gamma + p \rightarrow p + \pi^+ + \pi^- .$$

This process has been observed by passing the 1.1 Bev bremsstrahlung beam of the Cornell electron synchrotron through a high pressure hydrogen filled diffusion cloud chamber. Before passing through the chamber, the γ-ray beam from the synchrotron is passed through 4 meters of LiH which act to virtually eliminate the energy region of the incident bremsstrahlung spectrum below 20 Mev. The meson pairs produced in the chamber by the γ-ray beam which emerges from this hardener are observed with a stereoscopic camera. The reprojection of an event in a stereo-projector which is optically identical to the stereo-camera allows the reconstruction in space of the event as it originally occurred.

Some 40,000 exposures have been made and a sample of 108 charged π meson pairs has resulted from the scanning and analysis of this film. An additional 4 events have been found in which at least 3 mesons have been produced in the interaction of a γ-ray and a proton.

The results of the analysis of the π meson pairs are the energy of the incident γ-ray and the energies and directions of the three bodies in the final state of the reaction. The Q values of the proton-π^+, proton-π^-, and π^+-π^- systems have also been evaluated, and the total cross section for the production of charged π pairs has been determined as a function of γ-ray energy. The absolute magnitude of this cross section has been established by counting the relative numbers of meson pairs and positron-electron pairs produced in the chamber gas by the γ-ray beam.

The total cross section for the meson pair process rises sharply near 500 Mev in γ-ray energy. The cross section attains a value of ~ 70 μbarns in the region of 500-600 Mev and then appears to decrease slowly as the γ-ray energy increases.

Most of the events in the experimental sample are in the region from 500 Mev to 700 Mev in γ-ray energy. For the events in this energy group the π^+ mesons tend to be emitted isotropically relative to the γ-ray direction while the π^- mesons are emitted preferentially in the forward direction and the protons are emitted preferentially in the backward direction. The Q-values of the proton-π^+ system have a tendency to values near 170 Mev (the Q-value of the resonant 3/2,3/2 state) while the Q-values of the proton-π^- system have tended to substantially lower values.

The conclusions are that in this region of γ-ray energy from 500 Mev to 700 Mev that the behavior of the two mesons is not symmetrical. In this energy region the reaction appears to proceed mainly through the 2-body reaction $N^* + \pi^-$ where N^* is predominately the system (p,π^+) in the resonant 3/2,3/2 state. The forward-backward asymmetry in the emission of the π^- leads to the conclusion that if the final three body state results from some

intermediate state, C, which then channels to $p + \pi^+ + \pi^-$ or $N^* + \pi^-$ then C cannot be a single state but must be an admixture of at least two states with different parity.

Microfilm $2.00; Xerox $5.20. 105 pages.

THE RADIOACTIVITY OF SOME RUTHENIUM AND ERBIUM ISOTOPES

(L. C. Card No. Mic 59-2751)

Basant Lal Sharma, Ph.D.
The Ohio State University, 1959

In order to investigate the activity of Ru^{106}, the enriched Ru^{104} was exposed to a thermal neutron flux of 1.2 x 10^{14} neutrons cm^{-2} sec^{-1}. After the decay of the 40-day Ru^{103}, the silver impurity was removed and the contributions from Co and Eu impurities were subtracted. The 513- and 621- kev gamma rays of Rh^{106} were then verified to be in coincidence. The gamma ray energies and the coincidence results were consistent with the previously established results for this isotope. The thermal neutron activation cross section of Ru^{105} was calculated to be 0.20 ± 0.08 barns from the gamma ray intensities.

Enriched Ru^{101} bombarded with 6 Mev protons was observed to emit 75-, 310-, and 545- kev gamma rays, each decaying on a 4.4 day half-life. However, the lead and copper absorption measurements strongly indicated that the 75 kev photo peak, observed in well crystal measurements, was actually due to Pb K x-ray, produced by the photo electric absorption of 310-kev gamma ray in the lead shield around the crystal. A weak 235 - kev radiation was in coincidence with the 310- kev emission previously assigned to Rh^{101}. The latter is not in coincidence with the 545- kev gamma ray. After the decay of the 4.4-day activity, gamma rays of 127- and 198- kev were observed to be in coincidence and have a very long half-life. The 127-kev radiation is identified with Rh^{101} from the reported coulomb excitation of Ru^{101} and the decay of Tc^{101}. A Ru + d sample, allowed to decay for 13 years, strongly shows 127- and 198- kev radiations. A decay scheme of Rh^{101} having levels at 127, 310, 325, and 545 kev is also suggested.

An examination of the radiation emitted by various Er^{170} + n samples, obtained by neutron bombardment of enriched Er^{170}, revealed no activity which could be assigned to the previously reported 49.8 hr-Er^{172} and 63.8 hr-Tm^{172} activities. The half-life of Er^{171} was determined to be 7.5 hours by following the decay of various gamma rays with a scintillation spectrometer. The 113- and 308- kev gamma ray groups were observed to be in coincidence. It was evident from the well crystal measurements that previously reported 360- and 420- kev photo peaks were sum peaks of Tm K x-ray and 308- kev gamma ray and of 113- and 308- kev gamma rays respectively. In the present investigations, the gamma rays, emitted because of the presence of Yb, Tm, Sc and La impurities in the Er^{170} + n sample, were observed to decay on different half-lives. The only observed radiation from isotopes of erbium other than Er^{171} was 0.33 Mev beta group of Er^{169} (9.4 day). In order to study the beta decay of 1.9-yr Tm^{171}, the Er fraction, obtained by ion-exchange column separation of Er^{170} + n, was allowed to decay for a few weeks. The well crystal measurements were then made. Apart from Yb K x-rays and their escape peaks, the above measurements showed the presence of a highly internally converted photo peak at 67 kev. The proposed decay scheme of Tm^{171}, together with spin assignments of various states, has been discussed. Microfilm $2.00; Xerox $4.60. 89 pages.

DETERMINATION OF THE LOCATION OF THE CENTER, OR CENTERS, OF PROJECTION IN ANOMALOUS CORRESPONDENCE

(L. C. Card No. Mic 59-2544)

Neal James Bailey, Ph.D.
The Ohio State University, 1954

Crossed eyes, squint, or strabismus are synonymous terms denoting an inability to direct both eyes to a single object. Although this condition very rarely causes any real pain and probably interferes little with the performance of most every day tasks, for centuries it has been the subject of investigation by workers in the field of vision.

Two reasons probably best explain this interest: first, an understanding of the visual act in squinters is necessary for a complete understanding of binocular vision, and secondly, this clearly visible defect imposes upon the possessor the stigma of inferiority. Hence, persons who have this defect want it corrected.

It is customary to describe the visual perception of space by saying that perceived images of objects are "projected" out into space from a "center of projection." The term "projection" is not used to imply that an observer first becomes aware of a point on the retina being stimulated and then uses this information to construct an image which he "projects" somewhere into the space surrounding him. The observer is aware only of an impression of the object which exists in space in front of him. He is not conscious of having received coded bits of information which have to be re-interpreted as an impression of an object.

Figure 1 illustrates one of the experimental arrangements used to locate the center of projection in the case of monocular fixation, it also illustrates what is meant by center of projection. In carrying out the experiment, the subject was seated at a comfortable height before a specially constructed table. He was permitted to see the three objects, P, P_1, and P_2 on top of the table and was required to localize them with his hands which were kept hidden from view under the table. These targets were arranged

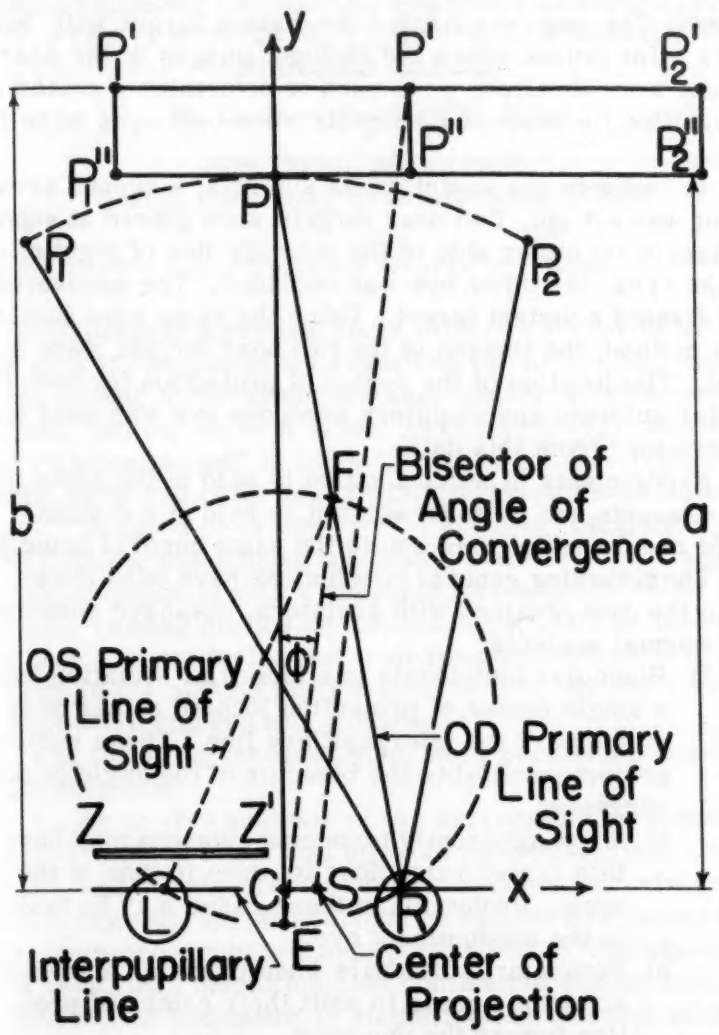


Fig. 1. Schematic illustration of one of the experimental arrangements used to locate the center of projection in the case of monocular fixation with the right eye.

on an arc of 40 cm. radius which was concentric with the midpoint of the interpupillary line. Each target was separated from the adjacent one by a distance of seven cm. measured along the arc; the center target, P, was placed in the midsagittal plane of the observer. This target was fixated by the right eye. A cover, ZZ′, was used to occlude the left eye.

Images of P, P_1, and P_2 falling on the retina of the right eye were seen by the observer at the points P′, P_1', and P_2' respectively.

In order to determine the location of the center of projection, it is necessary to be able to identify the position of points in physical space which correspond to P′, P_1', and P_2'. It is also necessary to know the direction of the lines which lead from these points to the center of projection. These are called lines of projection. Lines of projection are the lines in visual space which are analogous to the lines of sight in physical space.

The locations of P′, P_1', P_2' must be deduced from several types of information:

1) Knowledge of the lateral separation of the two visually perceived points, P_1' and P_2'. A person's ability to use his hands to indicate the distance of a visually perceived point is relatively poor, but he can use his hands with reasonable accuracy to indicate the lateral separation of two visually perceived points. The hands can be used, therefore, to get this type of information.

2) Angular separation of P_1' and P_2'. The eye's perception of the angular separation between P_1' and P_2' measured at the center of projection is in close agreement with the actual angle between P_1 and P_2 measured at the entrance pupil, R.

3) Location of the center of projection in a fore and aft direction. It is assumed that the center of projection lies somewhere on the interpupillary line. If it were located in front of or behind this line, this would lead to conflicting information about angular separations of objects at different distances. This assumption is basic to the assumption made above that angular separations are seen correctly.

4) The direction of projection of the foveal impression of the fixating eye. The direction of projection can be measured directly in the case of distant objects, and from this measurement one can determine the direction of projection for near objects by making the necessary allowance for phoria.

The above experiment can be carried out with an occluder placed over one eye, with a partial occluder over one of the eyes in order to restrict vision for the one eye to the central target (the other eye sees all of the targets), or without any occluder and with both eyes fixating the center target. One can assume that P_1'' is at the same distance from the midsagittal line as P_1', although it may be displaced from it in a fore or aft direction. This also applies to P_2' and P_2'' and to P′ and P″. This means that

$$\overline{P_1' P_2'} = \overline{P_1'' P_2''}$$

Since angle $P_1'SP_2'$ = angle P_1RP_2, it follows that

$$\overline{P_1'' P_2''} \ \overline{P_1 P_2} = \frac{b}{a}.$$

Hence, one can compute the distance, b, to the frontoparallel plane in which the images of the targets lie.

When point P′ has been located, the remaining problem is that of determining the direction of projection of the image P′.

This information can be obtained by measuring the direction of projection of the image of a distant object by having the subject walk toward the object and by measuring the effect of accommodation on convergence and direction of projection and by making an allowance for the effect of accommodation.

In the case of normal binocular subjects, one can assume that the direction of projection, SP′, is parallel to the bisector, EF, of the angle of convergence.

One can therefore draw a line through P′ parallel to EF. This line intersects the interpupillary line at the center of projection, S.

The data in the above experiment can be analyzed by plotting the apparent displacement of the objects from the midline against their actual displacement from the midline. In general, the data of the three points conform to a straight line (Fig. 2). The slope of this line may be used as a measure of the ratio of b to a. The y-axis intercept represents the displacement of $\overline{P'}$ from the midline.

The experiment for measuring the direction of projection was set up in a large open field. Each subject was required to walk toward a target placed 1000 yards away. A measurement of his path deviation was used to evaluate the correctness of his projection using either eye. All clues except the target itself were removed from the subject's view by the use of special "peephole" goggles worn over his regular spectacles.

A check on the effect of accommodation on projection

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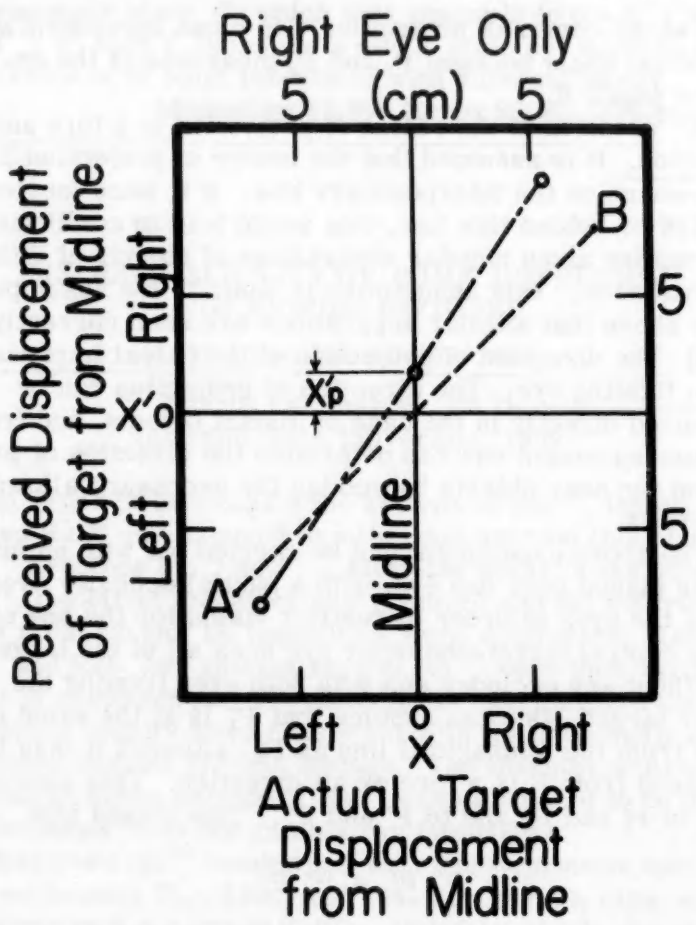


Fig. 2. A graphical method of analyzing data obtained in the Three Target Arc experiment.

was provided by using plus and minus lenses over the observer's regular spectacles while he was localizing with his hands the targets in the Three Target Arc arrangement.

Data relative to the location of the center of projection for seven binocular subjects, two one-eyed subjects, and ten squinters are presented in conjunction with the Three Target Arc. Esotropes and exotropes, including both monolaterals and alternators, were included among the squinters used. Two of the squinters possessed normal correspondence; the other eight demonstrated responses characteristic of anomalous correspondence.

In order to determine whether the curve shown in Fig. 2 should be represented as a straight line or an ogive, a five target arrangement was set up. Conditions of this experiment were similar to those for the three target experiment previously described. This experiment shows the curve to be an ogive. The most peripheral target on each side was localized by the subject so that the separation between it and the adjacent target as indicated with the hands was less than the separation indicated for the three middle targets. The fact that an ogive appears when targets are placed well toward one side of the midsagittal plane probably indicates that either the hands make an error toward underestimating their displacement from the midline, or the eye does not evaluate correctly the angular displacement of objects placed well away from the point of fixation.

In the above described studies, fixation was maintained in the plane of the targets. Two experiments were set up in which fixation was held on a target placed 5.7 meters in front of the subject in his midsagittal plane.

One of these investigations made use of a single target placed within arm's reach in the observer's midsagittal plane. The observer fixated the distant target with both eyes. The points where the diplopic images of the near target were localized were used to determine a center of projection for binocular subjects when both eyes were in use.

In order to use squinters as subjects, a second arrangement was set up. Two near targets were placed at equal distances on either side of the primary line of sight of one of the eyes; the other eye was occluded. The uncovered eye fixated a distant target. Using the same hand localization method, the images of the two near targets were localized. The location of the center of projection for both binocular subjects and squinters when one eye was used was determined from this data.

Experiments in which fixation is held in the plane of the near targets and those in which it is held at a distance yield results which conform to the same general principles.

The following general conclusions have been drawn from the data obtained with squinters, one-eyed subjects, and normal subjects:

1) Binocular individuals in a binocular situation have a single center of projection located rather near the midpoint of the interpupillary line. These subjects project parallel to the bisector of the angle of convergence.
   a) Some apparently binocular subjects may have this center very close to, even in, one of the eyes. Projection in these cases may be faulty in the nondominant eye.
   b) Binocular individuals when placed in a monocular situation appear to shift their center of projection toward the eye used.
2) One-eyed individuals who have completely adapted themselves to the use of the remaining eye have a center of projection in this eye and project along the line of sight of the functioning eye.
   a) Those who have only recently lost an eye appear to use as the center of projection a point near the previously used binocular center of projection, but rapidly learn to ignore effects of accommodation on near localization.
3) Squinters appear to have a center of projection located approximately in the eye used for fixation.
   a) Monolateral normal correspondence squinters project parallel to the line of sight of the dominant eye.
   b) Anomalous correspondence squinters project parallel to the line of sight of the fixating eye.

Supplemental studies relating to an individual's ability to demonstrate a knowledge of the position of his head, shoulders, arms, and body with reference to objects placed in front of him were also carried out using binocular subjects, one-eyed subjects and squinters.

Microfilm $2.25; Xerox $8.00. 172 pages.

Abstract published by special arrangement with The Ohio State University.

RELATIONSHIP OF BLOOD PROTEIN COMPOSITION TO INTRAVASCULAR ERYTHROCYTE AGGREGATION (SLUDGED BLOOD)

(L. C. Card No. Mic 59-2428)

Jørn Ditzel, M.D., Ph.D.
Boston University Graduate School, 1959

Major Professor: Professor George P. Fulton

The present investigation is directed to clarify the controversy in the literature regarding the nature and mechanism leading to intravascular aggregation of erythrocytes. Knisely and co-workers (1945, 1947, 1950, 1951) maintain that "sludged blood" is not a "rouleaux", but an irregular clumping of red cells by a specific precipitate which cements the blood cells together. Fåhraeus (1921, 1929, 1948), on the other hand, maintains that the in vivo aggregation is identical with a rouleaux formation in which no specific coating occurs on the red cells, and that the major factor in producing the rouleaux phenomenon is a change in the plasma protein distribution, mainly an increase in fibrinogen and globulins.

The following investigations were performed and results obtained:

1. An in vivo analysis of the aggregation phenomenon termed sludged blood was made in the conjunctival vessels of 167 human subjects in order to evaluate the relationship of this aggregation phenomenon to that termed rouleaux. The biomicroscopic technique described by Knisely (1947) was used, with magnifications confined to 96X or less. However, the limitation in magnification inherent in this technique made it impossible to visualize clearly the structural details of the red cell aggregates. No microscopically visible "coating" around the red cell aggregates could be distinguished such as that reported by Bloch (1956). However, the form of the aggregates seemed to differ in the arterioles as compared with the venules, depending in part upon the amount of shearing force and the caliber of the vessels.

2. Comparative studies were made relating the degree of intravascular erythrocyte aggregation to the composition of the serum proteins, lipoproteins, and protein-bound carbohydrates as determined by paper electrophoresis. In 157 determinations, a significant relationship was shown between increased intravascular erythrocyte aggregation and an increase in α_1-, α_2-, and β-globulins and a simultaneous decrease in the albumin fraction of serum. One hundred and twenty-eight serum lipoprotein determinations showed a correlation between the degree of aggregation and the amount of total lipoprotein and its two component fractions, α- and β-lipoproteins. One hundred and eighteen serum protein-bound carbohydrate determinations showed no direct relationship between these component fractions and the degree of aggregation.

3. An in vivo analysis of the aggregation phenomenon was made in the cheek pouch of 100 hamsters in order to evaluate the morphology of the aggregation by means of a transparent preparation permitting clear visualization at magnifications as high as 1200X. The biomicroscopic technique described by Fulton, Jackson and Lutz (1947) was used.

4. A comparative study of the microcirculation and the serum protein distribution of 24 corticosteroid-treated and 35 total body x-irradiated hamsters showed a similar significant relationship between the degree of aggregation and a decrease in the albumin/globulin ratio.

5. Based on observations of the microcirculation in hamsters, a difference in degree only, and not in kind is reported for the simple serpent-form rouleaux, the conglomerate of rouleaux, and the completely irregular masses in which no rouleaux could be detected. Similar to findings in man, the form of the aggregates differed, depending upon their location in the microcirculation. In terminal arterioles where the shearing forces are great and the caliber small, the cells circulated either individually or in a simple rouleaux. In contrast, the red cells tended to form large irregular masses without evidence of rouleaux in the venules where the shearing forces are minimal and the caliber is greater. When microcirculation in the cheek pouch of the hamster was observed and photographed with the biomicroscopic technique of Knisely, the appearance of aggregated blood flow was similar to that seen in the conjunctival vessels of the diabetic subjects.

6. Paper electrophoretic studies gave evidence for the existence of an unspecified coating of protein nature surrounding the red cells in diabetic subjects with markedly altered protein patterns. This coating consisted of the same proteins, i.e. α_2-globulin and fibrinogen, which were found to be abnormally increased in the plasma.

From the present investigation it may be concluded that sludged blood observed in vivo in human patients is identical with rouleaux formation as defined by Fåhraeus. It is suggested that much of the controversy as to the nature of intravascular erythrocyte aggregation may be due to differences in interpretation of the definition of rouleaux. Microfilm $2.00; Xerox $5.40. 108 pages.

A STUDY OF THE CHANGES IN RESPONSIVENESS OF THE UTERUS OF THE CASTRATED RAT TO ESTROGENIC HORMONE IN RELATION TO AGE

(L. C. Card No. Mic 59-2723)

Tsung Yuan Liu, Ph.D.
The Ohio State University, 1954

The literature in regard to the relationship between the endocrine glands and the attainment of puberty by the female mammal has been reviewed.

Evidence was presented from the literature that the bodily changes of puberty depended on an increase in the activity of at least the anterior pituitary and gonads; a much smaller amount of work had been done on the role of receptivity of the target organs concerned in puberty to hormonal stimulation as a factor in the pubertal process as a whole. The purpose of the present study, therefore, was to explore this question further; more particularly, the study is concerned with the intrinsic changes, in relation to age, in the sensitivity of the uterus of female rats castrated at the 21st day of life to estrogen.

Female albino rats of the Sprague Drawley strain were used for the present experiments. Eight hundred and six female rats were ovariectomized or ovariectomized-thyroidectomized at 21 days of age. Thirty-two female rats were used as intact controls. An additional 81 adult female rats were ovariectomized at either 90 or 135 days of age. All the animals were maintained on Ralston Purina

Fox chow and water ad libitum. The ovariectomized-thyroidectomized rats were supplied with saturated calcium gluconate solution on the day of the operation and on the first day after the operation.

Groups of animals ovariectomized at 21 days of age were injected with alpha-estradiol at total dose levels of 0.00156, 0.00625, 0.025, 0.10, and 0.50 microgram at 24 and 16 hours prior to the time of autopsy, which was performed at the ages of 22, 26, 46, 66, 96, 156, and 186 days. Groups of similarly ovariectomized animals were also injected in the same way with alpha-estradiol at dose levels of 1.0 and 2.0 micrograms per 100 gm. body weight at the ages of 22, 26, 46, 66, 96, 126, and 134 days of age.

Groups of adult female ovariectomized rats were injected with alpha-estradiol at dose levels of 0.50 microgram per rat or with 2.0 micrograms per 100 gm. body weight at 24 and 16 hours prior to the time of autopsy, which was performed at 20, 30, or 75 days after ovariectomy.

Groups of animals ovariectomized and thyroidectomized at 21 days of age were similarly autopsied after injection with 0.00156, 0.00625, 0.025, 0.10, and 0.50 micrograms of alpha-estradiol at the ages of 26, 46, 66, 96, and 156 days. Each dose of alpha-estradiol was dissolved in a 0.10 ml. sesame oil solution, which was divided into two equal portions which were injected at 24 and 16 hours prior to the time of autopsy. In each age group of each experiment, the same amounts of sesame oil solution were injected into the ovariectomized or ovariectomized-thyroidectomized rats serving as controls.

At autopsy, the uteri of the rats were removed immediately and freed from the mesometrium and vagina. The uteri were weighed immediately with the fluid content intact on the Roller-Smith torsion balance. The uterine horns were then opened longitudinally, gently pressed on blotting paper to remove the fluid content, and reweighed to obtain the uterine weight without fluid content. The difference between the two weights was considered as the weight of the contained fluid of the uterus.

The sensitivity of the uteri of the ovariectomized or ovariectomized-thyroidectomized rats to estrogenic hormone stimulation was judged chiefly by the percentage of increase in weight of the uteri above that of the controls, and by the increase in fluid content of the uteri expresses as mgms. per 100 mgms. of uterine tissue. The absolute weight of the uteri and the absolute weight of the fluid content of the uteri were also useful criteria.

It was found, in general, that the maximum sensitivity of the uteri of the female rats ovariectomized at 21 days of age to estrogen occurred between 26 and 66 days of life. These ages extend on either side of the time of expected puberty for this strain of female rats. With further increase in age the sensitivity of the uteri of these ovariectomized animals gradually decreased. This phenomenon was most clearly seen with alpha-estradiol dose levels of 0.10 and 0.50 microgram per rat, and with 1.0 and 2.0 micrograms per 100 gms. body weight.

It was found that the duration of the post-castration period did not influence the sensitivity of the uteri of castrated adult female rats to estrogen when either 0.50 microgram of alpha-estradiol per rat and 2.0 micrograms of alpha-estradiol per 100 gms. body weight was used.

Thyroidectomy of the ovariectomized female rats eliminated the decrease in sensitivity of the uteri to estrogenic hormone stimulation which occurred ordinarily with advancing age in the ovariectomized rats with intact thyroids. Without the thyroid gland, a state of high sensitivity of the uteri to estrogen persisted throughout the duration of the experiment (26-156 days of age). These results were obtained with two dose levels of alpha-estradiol, namely, 0.10 or 0.50 microgram per rat.

It was concluded from the results of this study that a probably important, and perhaps essential, aspect of the pubertal process as a whole in the female rat is a change in reactivity of the uterus to estrogenic hormones secreted by the ovaries; this change occurred in the absence of any influence supplied by the ovaries themselves. Although such a phenomenon had not before been reported in the female, it is similar, in general, to one reported by Hooker in the male rat, in which a marked increase in sensitivity of the seminal vesicles and prostate to androgen stimulation occurs at the age of expected puberty in animals that had been castrated at birth. The nature of this intrinsic change in sensitivity is unknown.

Microfilm $2.00; Xerox $4.40. 80 pages.

Abstract published by special arrangement with The Ohio State University.

CALORIMETRIC STUDIES IN TEMPERATURE REGULATION: THE INFLUENCE OF COLD, NEUTRAL, AND WARM ENVIRONMENTS UPON PYROGENIC FEVER IN NORMAL AND HYPOTHALECTOMIZED DOGS.

(L. C. Card No. Mic 59-2279)

Ronald Halsey Thompson, Ph.D.
University of Pennsylvania, 1959

Supervisor: Professor James D. Hardy

To test the hypothesis proposed some years ago by Hardy, that the action of the physiologic temperature regulating system under a given set of external and internal thermal drives is determined by the sum of these drives, two series of total body calorimetry were performed on three mongrel dogs. The first series of experiments was carried out in cold, neutral and warm environments to determine the heat loss and heat production responses of the dog to external thermal drives. A second series of experiments was performed in the same environments following the injection of a pyrogen, Pseudomonas sp., to furnish the added internal thermal drive. To further evaluate the part played in these adjustments by the posterior hypothalamus, similar experiments were carried out on four dogs which had surgically induced lesions of the brain stem involving total or near-total extirpation of the hypothalamic gray matter.

Normal dogs responded to cold, warm, and neutral environments by large adjustments in heat production and heat loss with little or no change in rectal temperature. The normal dogs developed fevers of approximately the same degree in all thermal environments. At neutral temperatures (i.e., in the absence of external thermal drives) body temperature was raised by the combined effects of increased heat production and inhibiting panting and vasodilation. In warm environments there was little or no

increase in heat production but a marked inhibition of heat loss which resulted in the fevers. In cold environments, the temperature elevations were accomplished by severe shaking chills and a large increase in metabolic rate with little change in heat loss.

These results support the following conclusions:

(a) The thermal adjustments of the normal dog to acute exposure to warm and cold environments are determined by a peripherally located physiologic thermostat which responds to external thermal drives independently of small changes of internal body temperature.

(b) Pyrogens produce a regulated temperature elevation in dogs which develops independently of external thermal drives.

(c) Control of heat loss and heat production in the establishment and maintenance of the elevated temperature is compatible with the hypothesis that the pyrogenic action serves as "cold" stimulus to "set" the physiologic thermostat at a higher than normal temperature.

(d) The particular adjustments of heat loss and heat production observed in the cold, neutral and warm environment are compatible with the hypothesis that the physiologic temperature regulating system in the dog responds to the sum of the warm and cold drives as postulated by Hardy.

Microfilm $2.00; Xerox $3.80. 69 pages.

OXYGEN POISONING AND RECOVERY IN THE ANNELID, TUBIFEX TUBIFEX

(L. C. Card No. Mic 59-2062)

Joanne Gillespie Walker, Ph.D.
University of Illinois, 1959

Some aspects of oxygen poisoning in the annelid Tubifex tubifex have been investigated. Individually isolated worms were exposed to 100 per cent oxygen at 4 atmospheres and examined at frequent intervals following the exposure. Oxygen exposures of from one to eight hours result in only negligible injury. As exposure durations are lengthened beyond eight hours initial mortality is increased. Following exposures of 13 hours or more initial mortality is very great. Interruption of exposures results in enhanced survival. This survival increase is a function of the duration of interruption. This implies recovery from the initial oxygen damage. Survival of Tubifex following oxygen exposure is markedly enhanced by increasing the osmotic concentration of the external environment. The increased survival of Tubifex is independent of the nature of the solute employed but is a function of the total osmotic concentration. Salt solutions are at least partially effective in enhancing survival of Tubifex even if added several hours after oxygen exposure. The effects of increased osmotic concentrations are not specific for oxygen poisoning alone but are also effective against heat stress and hydrogen peroxide and so may have application in protection against other environmental stresses.

Microfilm $2.00; Xerox $3.60. 67 pages.

POLITICAL SCIENCE, GENERAL

SELECTED CASE STUDIES OF THE LEGISLATIVE LEADERSHIP OF GOVERNOR HERBERT H. LEHMAN

(L. C. Card No. Mic 59-2836)

Jewel Lubin Bellush, Ph.D.
Columbia University, 1959

This study of Governor Lehman's legislative leadership analyzes his constitutional position and his extra-legal role as a popular and party leader. The dissertation explores each of these sources of power to illustrate their impact upon the character and activities of a New York Governor. In addition, the relationship of Lehman's personality, his attitudes towards his office, the influence of history, the traditions of executive leadership inspired by Governors Hughes, Smith and Roosevelt, and the role of parties and interest groups are analyzed in terms of their impact on Lehman's performance.

Since my objective was to analyze the Governor's legislative leadership, I decided to utilize the case approach, i.e., concentration on a single issue in each chapter. Each case study attempts to describe the nature of the Governor's legislative power--the shaping of an issue by political, economic and social conditions, its movement through the Governor's office, the tactics of various groups which affected the program's formulation, and the Governor's response.

Lehman's struggle to establish a centralized system of liquor control illustrates the importance of a study group as leverage for legislative leadership. Lehman's appointment of a "non-political" commission to explore plans for liquor control was an attempt to insulate the group from possible "partisan" influence. This tactic created several problems and the chapter is an attempt to analyze each of these and how Governor Lehman extricated himself from a seemingly untenable position.

Lehman's leadership in the evolution of milk price control in 1933 appears to have been one of strategic abstention due primarily to difficult problems which had engulfed the dairy industry and to the lack of unanimity within it. The remedies, therefore, which might be applied to mitigate some of the milk problems were numerous and varied. The Governor recognized these facts and refrained from extending leadership in support of legislation which was only a partial and inadequate remedy.

In contrast to his abstention in the development of milk price control, the Governor was compelled to assume a much more active role in the 1933 milk strike in order to preserve order and protect private property. This chapter highlights Lehman's difficulties in maintaining order among striking farmers--a group with which he had much sympathy.

The case study of the utility blockade illustrates the problems of a Governor when pursuing a program against an effective interest group invested with economic power and significant political influence. Within a year the blockade was broken and the involved relationships between interest group and legislature exposed. This required more than ordinary leadership by the Governor and outside assistance.

The Governor's response to Mayor LaGuardia's economy bill of 1934 was largely molded by the political and economic setting in New York City from 1929 through 1933. This case study also highlights the nature of the Governor's responsibility as party leader, protector of certain interest groups, and the importance of bargaining as a technique for successful leadership.

The 1939 budget battle illustrates the importance of the Governor's financial authority in the Empire State. Following Republican attempts to cut his budget through alterations of his appropriation bills, Lehman resorted to the courts. He won the constitutional question and preserved executive power. However, due largely to changes in the political and economic climate, the G.O.P. finally slashed Lehman's budget program in 1939.

In general, the primary influences on Lehman's performance were: the legal framework within which a New York Governor operates, a rich inheritance of executive leadership, the social and political setting, the state's party system, the role of interest groups and Lehman's personality, attitudes and skills.

Microfilm $4.95; Xerox $16.60. 387 pages.

TREATIES AND EXECUTIVE AGREEMENTS: THEIR SEPARATE ROLES AND LIMITATIONS

(L. C. Card No. Mic 59-2972)

Elbert M. Byrd, Jr., Ph.D.
The American University, 1959

Supervisor: Dr. Robert E. Goostree

Statement of the problem:
Can a determination be made as to the distinctive roles and limitations of both treaties and executive agreements within the confines of United States constitutional law? To what degree are the instruments interchangeable? What is a general constitutional guide for selection between the instruments as determined by the subject matter of a particular agreement?

Procedure:
After analysis of the foreign affairs provisions of the Constitution ex facie, attention is then given to the historical data, including national and state convention debates, Federalist and anti-Federalist papers, with particular attention paid to the Jay Treaty debates which embodied more specific statements by men all of whom were Founding Fathers. The treaties made by the Founders are examined, as well as the record of the Supreme Court cases on

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

both treaties and executive agreements, and the history of unadjudicated agreements, including those first authorized in 1790. Throughout, collateral issues are considered, such as the inherent power theory, the Senator's role as a plenary representative of his state, and the arrangements of other federal governments.

Results:
A most important result is the emphasized importance the evidence places on the Senator as both a state and national official in the treaty approving role, pointing to a new statement of a theory of the treaty power which reconciles many of the theoretical problems in this field. The treaty making agency emerges as a distinctly separate branch of the government, demanded by the Constitution to be seen in this light in just as emphatic degree as the other branches of the government. State compacts with foreign governments may be used to good effect both from a state and national point of view. Other federal governments, especially Canada, offer interesting comparisons; all federal governments tend to provide either for regional agreements with foreign governments or for an extraordinary procedure for invoking full treaty powers by the central government.

Conclusions:
The inherent powers doctrine is rejected; all foreign affairs powers are derived from the Constitution. The treaty power is limited by the specific prohibitions of the Constitution, of which the Tenth Amendment is not one, and by necessary implications. The Senator, in approving a treaty, acts both in a state and national capacity. Even strict constructionists recognized the treaty power as substantive. The legislative powers of Congress may authorize international agreements on a broad scale, but they may not be used for agreements which interfere with the reserved powers of the states as contemporaneously construed by the Supreme Court. The President's power to enter into executive agreements is something less than his powers and the legislative powers combined. Executive agreements of all types cannot, therefore, be completely interchangeable with treaties. Where the instruments are interchangeable, the executive agreement method is preferable, especially to give recognition to the legitimate powers of the House. The major limitation on executive agreements made under the President's powers alone is the extent of his ability to implement the agreements under powers of the President alone; to promise more than he can perform is to court disaster abroad and at home. The national value of Presidential agreements is best seen in the armistice agreement. There is little realistic basis for fearing abuse of the executive agreement. The Constitution explicitly recognizes treaties and state compacts with foreign governments, and implicitly sanctions what are called Congressional-Executive agreements and Presidential agreements. Clarifying definitions of these and other terms are proposed, along with indications of further needed research.

Microfilm $4.70; Xerox $15.80. 367 pages.

JOHN AUSTIN AND JURISPRUDENCE IN NINETEENTH CENTURY ENGLAND

(L. C. Card No. Mic 59-2380)

Enid Mona Campbell, Ph.D.
Duke University, 1959

Supervisor: John H. Hallowell

This work represents the first part of a projected series of studies of English jurisprudence up to 1914. It consists of an exposition, interpretation and criticism of the political and juristic thought of John Austin (1790-1859), England's first Professor of Jurisprudence and the chief architect of English legal theory during the nineteenth century.

The first chapter is devoted to an account of Austin's life and career and includes a commentary on the circumstances attending the writing and publication of his works. This is followed by a discussion of Austin's version of Utilitarianism in relation to the ideas of Locke, Bentham and to other representatives of the Utilitarian school. The application of Austin's theory of ethics is discussed in the chapters concerned with his political theory. The bulk of the analysis is taken up with Austin's delimitation of the province of jurisprudence, his theory of sovereignty, his approach to the problem of defining law, his fragmentary comments on the judicial process, his advocacy of codification, and finally, with his separation of law from morality and the validity and expediency of his distinction between law as it is and law as it ought to be.

For the purpose of assessing Austin's influence in the development of English jurisprudence his adeas have been presented within the context of the juristic thought of his immediate predecessors and of his successor jurists. Two lengthy chapters attempt to survey the course of English jurisprudence during the Victorian era and the development of jurisprudence as an academic discipline.

The discursive as opposed to the expository sections of the study relate to the definition of law, the theory of sovereignty and the relation between positive law and morality. In discussing the problem of defining law the author has proceeded on the basis that definition is a stipulative operation and that the search for the essence or for the universal form of law is fruitless. While it is contended that definitions are neither true nor false and that Austin's critics were in error in alleging that his definition of law was false, it is suggested that there are standards of appropriateness in definition, and that Austin's definition is to be criticized for its failure to provide for rules commonly regarded as legal in character, e. g., permissive rules as distinct from imperatives.

In reply to the critics of the Austinian theory of sovereignty it is urged that Austin was not attempting to provide a complete explanation of political authority but was attempting to fix a criterion for assessing the validity of rules as law and that as such, it must be regarded as having only limited significance. Nevertheless, it is submitted that the problem of formulating criteria of validity is better solved by postulation of a set of basic rules prescribing law-making procedures (which would include constitutional rules).

The one aspect of Austin's jurisprudence which is not subjected to destructive criticism is his separation of law and morality and his distinction between law as it is

and law as it ought to be. The only criticism which is offered is that Austin's analysis of the interrelationship of the two spheres is incomplete and that it does not draw sufficiently from the data of legal systems in operation. In the light of the ideas of later Victorian jurists it is concluded that the legal positivism exemplified in the writings of Bentham and Austin became a distinguishing feature of English jurisprudence which has persisted to the present day. In this connection the author has examined and commented upon the recent debate between Professor Lon Fuller of Harvard University and Professor H. L. A. Hart of Oxford University.

A question raised but not fully answered is whether the concept of the legal order or system better serves the purpose of the basic concept of jurisprudence than does law. Microfilm $6.80; Xerox $23.40. 535 pages.

THE PRIVATE MEMBER OF PARLIAMENT AND THE FORMATION OF PUBLIC POLICY: A NEW ZEALAND CASE STUDY

(L. C. Card No. Mic 59-2385)

Robert Nathaniel Kelson, Ph.D.
Duke University, 1959

Supervisor: R. Taylor Cole

Recent writers have alleged that the responsibilities and influence of the private Member of Parliament (M.P.) in relation to the formation of public policy have declined almost to the vanishing point. The purpose of this study is to describe the activities of the New Zealand M.P. relative to public policy, in order to ascertain how much influence he still retains. Primary consideration is given to the M.P.'s activities in his political party organization, his parliamentary party, and in Parliament itself, particularly during the decade from 1946 to 1955.

The private M.P. has some opportunity to influence the election program to which his party will be committed for the ensuing term of Parliament. In the Labor Party, the private M.P.'s position in the party organization outside of Parliament enables him to exert some influence. He gets his best opportunity to influence public policy through the weekly meetings of the parliamentary Labor party. There have been a number of occasions when the Labor private Member has exercised some initiative. However, his role is usually confined to an opportunity to veto or modify provisions of already drafted legislation which he and a substantial number of his colleagues do not favor.

In the National Party, there is little participation by the M.P. in the party organization outside Parliament, but that organization possesses little influence itself. When a National government is in office, the National M.P. usually gets an opportunity to consider the main features of legislation which the Cabinet plans to introduce into Parliament. Through the caucus committees of the parliamentary National party, he may play an important role in the formulation of legislation in its early stages. However, the parliamentary National party has served more as an aid to, than a master of, the Cabinet.

In Parliament itself, private Members' activities are centered around the use of private Members' time, participation in debates on the floor of the House, activities in select committees, and voting. Time specifically allocated for the consideration of private Members' business has been severely restricted and has tended to decrease. Private Members' bills are limited in number and are rarely allowed to proceed beyond second reading. Only a few such bills have been passed or adopted by the government in recent years. The discussions of ministerial replies to questions have not on the whole proven to be effective, both because of the parliamentary devices used and because of the attitudes of the M.P.'s themselves.

Private Member participation in debates has been extensive, but these debates have not generally been of high quality and have had little direct influence on legislation. The M.P. has been more active and more effective on parliamentary committees. Important bills, particularly when they have not aroused major political controversy, have been changed through the efforts of private Members sitting on select committees, and especially on the Statutes Revision Committee.

With regard to voting, the party system and party discipline have almost completely nullified the significance of the private Member's individual vote in Parliament. Party discipline has been breached only twice in ten years. Free votes on public issues are rare.

The limitations on the private Member's ability to determine the final content of legislative enactments also restrict his ability to represent the views of his constituency on policy matters. However, he is sometimes successful in securing personal benefits for his constituents.

The private Member has not lost all power to influence policy-making in New Zealand. He has found in the parliamentary party a channel for limiting some of the effects of the tightening of party discipline in Parliament itself. Even in Parliament, he is left sufficient scope to raise him well above the level of a cypher in public policy-making. Microfilm $4.90; Xerox $16.40. 381 pages.

JAPAN IN KOREA (1905-1910): THE TECHNIQUES OF POLITICAL POWER

(L. C. Card No. Mic 59-2831)

Chong-Ik Kim, Ph.D.
Stanford University, 1959

In power relationships between two or more individuals or groups, one of the most intricate and difficult problems is how one individual or group is able to exert his will over the others and to promote his interests while engendering the least amount of antipathy among them. When the relationship involves two nations and the problem is connected with one nation's obliteration of the other's independence, the framework for a solution is undoubtedly magnified far beyond what might be conceived of between smaller units in the struggle. This thesis evaluates as objectively as possible how successfully Japan solved various problems involved in annexing Korea, 1905-1910. This work is not concerned with the question of whether power must have a moral basis or not, nor does it deal with the problem of whether techniques of debatable ethical value should be used in political relationships. The modest aim of the author is to re-emphasize the composite

nature of the power process and to point out the conditioning influence of particular segments of the power situation which existed between Japan and Korea.

Political Power as used here means the relationship between two or more individuals and groups, the possession of which is indicated by the ability to exercise authority and control over the actions of the others. Also, the word Technique means all methods, expert or opportunistic, in any power relationship.

After 1905, if not before, the Japanese objective in Korea was eventual annexation of the peninsula kingdom. There was, however, more than one "prince" in the Japanese decision-making process, the complexity of which often resulted in ambivalence in Japan's policy toward and its execution in Korea. Also, Japan in the consolidation of her power in Korea faced not only one "prince" but the whole Korean society highly stratified in its political and social framework, in addition to foreign sympathizers. Japan was constantly haunted by the ghost of possible intervention by other Powers on behalf of Korea as well as Korean revolt against Japanese rule in this formative period.

To the gratification of Ito, a Japanese elder statesman who became the first Japanese Resident-General in Korea, and the supporters of his policy of gradualist diplomacy with regard to Korea, no foreign intervention ensued in the wake of the conclusion of the Japanese protectorate treaty with Korea in 1905. However, the Japanese government for the moment had to be satisfied with its role of guidance in Korean affairs. Japan, following the protectorate treaty with Korea, left many problems in Korea unsolved. The Korean ruling oligarchy, left intact by Ito for the purpose of seeking its collaboration in Japan's assimilation process in Korea, was the first to attempt to subvert the Japanese overlordship. Moreover, at each control measure leading toward final annexation there followed fresh rioting among the Koreans and a gradual increase in political awareness among the masses, which was encouraged by political agitation carried on by the informal elites in the transition period.

Japan annexed Korea on August 22, 1910. And, the Korean opposition to the Japanese overlordship patterned the subsequent Japanese rule in Korea -- a colonial military dictatorship which lasted for thirty-five years until Korea was finally liberated by the Allied forces following the Japanese surrender on August 15, 1945.

Lastly, throughout this work, effort has been made to make full use of the Japanese archives in Korea (1894-1910), on deposit at the Hoover Institution, Stanford University, and of the Japanese foreign ministry archives microfilmed for the Library of Congress.

Microfilm $4.30; Xerox $14.40. 333 pages.

THE AMERICAN PEOPLE AND COMPULSORY MILITARY SERVICE

(L. C. Card No. Mic 59-957)

Denis Sinclair Philipps, Ph.D.
New York University, 1956

Adviser: Professor Ray F. Harvey

The obligation to perform military service is one of the most ancient of man's institutions. As with other institutions, it is essentially dynamic in that it has responded primarily to the changing concepts of war, the needs for military manpower, and also has adjusted itself to internal political developments. In addition, it has reflected the spirit of the people upon whom it has been imposed -- their ideals and their prejudices.

This study describes the overall experience of the American people with compulsory military service, the forms it has taken and the various forces which have shaped its development. Since safety from external danger is the most powerful influence affecting national policy, primary attention has been given to this factor. However, full attention had been given to national, local and ideological factors.

Part I describes the American experience with military service from the colonial period to, and including the War of 1812. During this early period military service was strictly enforced, and it was an accepted part of the life of colonial America. The reasons why this obligation was later relaxed, as well as the recruitment experiences of the Seven Years' War and the Revolutionary War, when the idea of volunteering became infused with the legend of America, are described.

In Part II the experiences of the American people in the Union and in the Confederacy demonstrate that in times of extreme national emergency, constitutional theory, as well as national ideals, must conform to the larger necessities of national survival.

Attention is given to the role of the European political system and its important implications for military security in America. Emphasis is placed on the growing international rivalry and its future portents for world peace. Concurrently with these developments, it is pointed out that America is departing from its traditional policies; of which the war with Spain offers conclusive evidence. Not the least of the consequences of this development is a forced reappraisal of the role of military organization in America. Furthermore, after a hundred years silence, the Congress again reaffirmed the obligation of all Americans to perform military service.

Part III, from 1900 to 1955, covers a period of vast international change in which the American people are obliged to reappraise their traditional security policies. America's involvement in World War I, with its adoption of national conscription, demonstrated that the United States had lost its immunity with respect to the world. Following the outbreak of World War II, the collapse of France and the imminent invasion of England forced the Congress to adopt the first peacetime draft in the nation's history.

With America's involvement, the full dimensions of the postwar problems were not realized until the Axis powers had been defeated. It was then recognized that the Soviet Union had emerged as a Eurasian power of major

proportions, which posed a major threat to the United States. One consequence of this development was the continued extension of the peacetime draft. By 1951 peacetime military service was becoming accepted as a relatively permanent part of the life of America. Four years later the Congress again extended the peacetime draft until 1959. It also enacted a Military Reserves Bill which marked a further step in the direction of universal military training.

While in a great many respects the experience of the American people with compulsory military service has been distinctive, it is evident that when their national security has been threatened Americans have had no alternative but to submit, albeit with reluctance, to military conscription; even in time of peace. Whether the advent of thermo-nuclear warfare had finally made war obsolete, and with it the institution of compulsory military service, is, of course, a question for the future to decide.

Microfilm $6.70; Xerox $23.20. 528 pages.

EDUCATION, RELIGION AND POLITICS: A STUDY OF THE CONTEMPORARY CONFLICT OVER PUBLIC SERVICES FOR PAROCHIAL SCHOOL PUPILS IN CONNECTICUT

(L. C. Card No. Mic 59-738)

Theodore Powell, Ph.D.
Columbia University, 1958

The question of public services for parochial school pupils in Connecticut caused conflict in several towns in 1956 and in the state legislature in 1957.

Partisans in these struggles looked to opinions of the United States Supreme Court to support their position. The complexity of the Court's views on church-state relations in education was compounded by strong and numerous minority opinions. The Court set forth three doctrines; church-state separation, the child benefit theory and church-state cooperation. The first two, while not necessarily in conflict, do raise difficult problems in distinguishing between aid to the child and aid to the religious school. There is, however, inescapable conflict between the principles of separation and cooperation. The Court's inclination to leave decisions in this area to the states crucially diminished the First Amendment's prohibition of religious establishment as a federal constitutional principle.

Studies of conflicts in four Connecticut towns show that Protestant members of school boards opposed public services for Catholic school pupils and Catholic members favored services. Protestant and Catholic clergymen were similarly opposed. The political activities of clergymen in local politics intensified community division. Protestants invoked the separation principle to argue against services and the cooperation principle to argue for religion in the public schools. Catholics used the contradictory arguments that (1) services aided the child, not the school, and (2) that the schools, because they performed a public service, were deserving of aid. Principles used on both sides were instruments rather than convictions.

Republicans in the 1957 legislature, with overwhelming control of both houses, were divided over a proposal to let the issue of auxiliary services be decided by a local referendum in parochial school towns. Republican leaders, conscious of the importance of the "Catholic vote" in statewide elections, and legislators from "Catholic" areas, supported the proposal. Other Republicans opposed it. Democratic legislators unanimously supported it. The Democratic Governor was silent.

Outside of the legislature a bitter conflict was generated by Catholic and Protestant clergymen. Jewish groups were inactive. Multi-sectarian civic groups, afraid of splitting their organizations, avoided the issue. Newspapers, for the most part, were timid. The conflict was left to the legislature to resolve. After a long series of parliamentary maneuvers, the bill, limited to transportation, was passed by the Speaker's vote. The Governor signed it without comment.

Forced to a reluctant decision, the legislature passed the question back to the towns. Divisions in the legislature were minimized and largely repaired afterwards. Spokesmen for Protestant and Catholic groups seemed determined to carry on the conflict.

This study suggests that religious leaders tend to act for their groups on a public policy question without consulting the membership and do not discuss their differences with each other. In a public policy dispute, clergymen act as crusaders. Politicians search for a compromise.

Passage of the school bus bill did not end Protestant-Catholic struggles in Connecticut politics. The issue would be fought locally. The next legislature would face a proposal for a constitutional amendment to limit direct or indirect aid for religious schools to transportation only. A renewed attempt could be expected to repeal the birth control prohibition law. There was likely to be an effort for public aid to private, including sectarian, colleges. It was probable that the political careers of leading partisans in the struggle over the school bus bill would be adversely affected.

If the procedures for handling the 1957 school bus bill dispute are followed in future denominational disputes, there is likely to be an increase in religious-political tensions in Connecticut.

Microfilm $5.50; Xerox $19.20. 429 pages.

POLITICAL SIGNIFICANCE OF LABOR CONDITIONS IN IRAQ, EGYPT, SYRIA, AND LEBANON

(L. C. Card No. Mic 59-2615)

Salim A. K. Salim, Ph.D.
University of Southern California, 1959

Chairman: Professor J. Eugene Harley

Iraq, Egypt, Syria, and Lebanon are Arab countries, and all are members of the United Nations, the International Labor Organization, and the Arab League. Basically, they are agricultural countries, this being the traditional business of the majority of the native population. It was not until after World War II that new powerful drives for general reforms came to be noted. The existing

authoritarian systems of government were still unwilling to deal with such pressures for change and development on the one hand and afraid of disturbing the existing status quo within their areas on the other. This is the central point of friction. The years between the two World Wars, the Western intervention, local educational efforts, the immense influence of the new spirit of nationalism in the area, as well as the international developments in general, awakened the people of these countries to what could and should be done.

More popular participation and representation in governmental affairs were demanded, better schools, improved medical care, more jobs, stronger national economic planning, and more political toleration were pressed for.

Nationalism in general is a powerful guiding influence in the struggle of the people to establish real democratic systems of government. The states have the political as well as the legal powers to deal with such issues, and force was resorted to repeatedly.

However, suppression of this type was not successful in disbanding such popular efforts. In several cases these pressures led to either bloody revolts or successful coup d'état that were not expected by the ruling groups.

The popular movements for reform were usually led by persons or groups of the middle or the better trained of the lower classes (in the economic sense of the word). The reason behind this is that these groups were customarily the most neglected, the least taken care of, and the largest in number. The farmers and the industrial workers of all these four countries fall within this group. They usually work for either a landlord or an owner. In both cases the owner is the final authority in deciding cases of conflict. Unionism was illegal until recently, and when legalized such a privilege was denied the farmer.

Until recently, labor laws of these countries were either a collection of unrelated patches of legislation enacted to meet the special demands of the day or the result of compromising special interest. Normally, the specialized agencies of the government monopolized vast areas of action. Collective actions by the workers were usually discouraged and often prevented. The generally accepted principle was to allow as little change as possible.

Nevertheless, efforts of these governments (in recent years) to cooperate with the different United Nations agencies, especially with the International Labor Organization, have been significant. Participation in regional labor conferences and projects also has been encouraging. This does not mean that the said governments have adopted a similar attitude toward accepting and enforcing more of the known labor conventions.

With the establishment of the new regimes in the area, new attitudes toward labor and its hopes have been noticed. In such cases the new governments, seeking wider national support to their controversial policies, have decided to recruit the support of the labor front through special guiding agencies.

It is certainly obvious that the role of the government in such underdeveloped areas is a vital one. Its role in the industrial field is even more critical. Labor in all these countries demands more freedom, equality, tolerance, and, above all, genuine guidance and advice. The governments of the area can and should understand such hopes and do their best to meet them.

Microfilm $5.70; Xerox $20.00. 446 pages.

POLITICAL SCIENCE, INTERNATIONAL LAW AND RELATIONS

INDIA, RUSSIA, AND CHINA, 1947-1955: AN INTERPRETATION OF THE INDIAN CONCEPT OF NATIONAL INTEREST

(L. C. Card No. Mic 59-2734)

Sudershan Chawla, Ph.D.
The Ohio State University, 1959

In this study, an attempt is made to examine how the Indian leaders have conceived "national self-interest" for their new nation, especially as this concept is revealed in India's relationships with Soviet Russia and Communist China from 1947-1955.

The Indian meaning and interpretation of the concept of national interest is sought in many places, especially in the national policy-makers' discussion of India's aims and objectives. Although the policy-makers of the Indian Government have not discussed publicly in any depth their concepts of national policy, they have tried to explain at various times the broad aims which they hold for their country in the field of foreign policy. These explanations are often generalized and moralistic statements which seem to reveal little except noble sentiments, but they are based in large measure upon fundamental concepts and attitudes which throw significant light on the motivating forces of Indian foreign policy aims.

In its search for the Indian concept of national interest, this study also examines significant information which reveals the Indian leaders' attitudes toward Communism--its general ideology, its usefulness for India, the role assumed by the Indian Communist party--particularly for the insights which are gained therein about the national interest of India. The discussion on this subject makes it apparent that India's leaders are thinking of India's political security when they take cognizance of the fact that territorial integrity would have no meaning if within India Communist elements took over power and subjugated the internal and external policies of India to the designs of a foreign power. It is with this in mind that the Indian leaders, while being cooperative with Russia and China on the international scene, make every effort to prevent the local Communists from coming to power in India. Thus Indian leaders oppose any aid from Communist China or Russia to the local Communists and make it manifest that such a move by any of these countries is considered interference in the internal affairs of India, which independent India resents.

In scrutinizing the Indo-Soviet and Indo-Chinese relations over 1947-1955, this study examines the general relations among these countries during this period for the insight which is gained in regard to the objectives that the makers of Indian foreign policy have set for India. The trend of these relations shows that relations between India, Russia, and China during this period were marked throughout by a desire on the part of India to seek cooperation with Russia and China, displaying that in maintaining India's territorial security the policy-makers of India feel that they can not ignore the fact that Russia and China are powerful countries in the neighborhood of India. India's leaders appear to feel that one way a possible threat to Indian territorial integrity from these countries can be

averted is by making attempts to foster cooperation between these countries and India so as to remove any doubts on the part of these countries that India is hostile to them. Thus India has refused to join in any political alignment with a major camp.

This study also seeks to find the principles which are revealed in the policies and actions of the Indian policy-makers at crucial points in such situations as the Korean conflict or the Tibetan episode. India made a timely retreat in the issue of Tibet, because it soon became evident that in the face of Communist China's determination to extend its control over Tibet, India could neither aid Tibet militarily nor legally. Thus India's leaders felt that India's future security would be best guaranteed if the border outposts between India and China on the northern frontier were strengthened, and Tibet was not allowed to become the source of future friction between India and China.

In its conclusions this study shows that in thinking of India's national interest, the policy-makers of India are primarily concerned with maintaining the territorial and economic security of India.

Microfilm $3.90; Xerox $13.20. 304 pages.

LEAGUE OF NATIONS AND UNITED NATIONS MEMBERSHIP: A STUDY OF ADMISSION CONCEPTS IN PLAN AND PRACTICE

(L. C. Card No. Mic 59-2814)

Brownlee Sands Corrin, Ph.D.
Stanford University, 1959

This study presents chronologically, in ten chapters, the development of admission criteria and procedures as planned for and realized in the League of Nations and United Nations. Emphasis is placed upon the underlying factors of national interest, personal statesmanship, law, principle, and historical events promoting or retarding admission of every original member or applicant. Particular attention is given to the pre-organization planning stages with special regard to their evolution in the United States of America. Two additional chapters describe and analyze contemporary admission criteria and procedural methods available and necessary in the movement of an entity from a status of applicant to that of member. Potential applicants, possible future directions on membership questions, and the implications of expanding membership are outlined as well.

The conclusion is drawn that there has been a shift in emphasis from restrictive criteria limiting membership to "classic" states in the Western tradition - to concepts encouraging membership of entities with more limited capacities in both international affairs and internal development. The shift is attributed to the struggle for power between Russia and the United States, and to the impact of a rising nationalism in Africa, the Middle East, and South East Asia.

Original membership of small states is considered to be linked directly to their degree of relationship with the major Powers during the formative periods of both organizations. And due notice is taken of the increasing role of small states in determination of admission criteria and approval of specific candidates.

The "principle" of universality and the "factors" approved by the Assembly of the United Nations as guides to determine the extent of self-government under Article 73(e) of the Charter, are held to possess some significance for admission in the years ahead.

Procedural method is viewed as an area where the force of international law has demonstrated its greatest strength in admission questions, subjective criteria for admission requiring political decisions, moderated occasionally by moral and legal positions as well as public opinion.

Finally, it is maintained that the United Nations possesses four channels to encourage the movement of entities to stages of independence and subsequent membership: the trusteeship system; the non-self-governing territory "system"; an "observer" system; and the system of public debate and recommendation by the Assembly to stimulate constructive action by metropolitan states possessing potentially independent units.

Microfilm $7.20; Xerox $24.60. 565 pages.

THE DECLINE OF A MULTILATERAL POLICY FOR KOREAN RECONSTRUCTION: A CASE STUDY OF THE RELATIONSHIP OF THE UNITED NATIONS TO THE CONDUCT OF UNITED STATES FOREIGN POLICY

(L. C. Card No. Mic 58-2469)

Gene M. Lyons, Ph.D.
Columbia University, 1958

A study of United States policy on Korean reconstruction involves a number of major problems in this country's foreign policy: the problem of balancing the relative advantages and disadvantages of multilateral and bilateral aid programs; the problem of finding the proper perspective for taking military considerations into account in formulating foreign policy; the effect of party politics on foreign policy formulation; and the problem of determining the role of international agencies in the pursuit of national objectives. The purpose of this study is to analyze these problems as they arose in the history of the relationship between the United States government and the United Nations Korean Reconstruction Agency (UNKRA), an agency established by the General Assembly on December 1, 1950, to undertake a program of relief and rehabilitation in Korea.

The establishment of UNKRA had been predicated on military success for the United Nations forces and an early cessation of the hostilities that had been raging on the Korean peninsula since the communist attack of June 25, 1950. Even before the establishment of UNKRA, however, the United Nations forces had encountered a new enemy in Chinese Communist "volunteers" and were fighting a "new war" that dragged on for more than two and a half years. During these two and a half years, the United States moved from active support of a multilateral reconstruction program through UNKRA to the initiation of a bilateral program of economic and military aid to the Republic of Korea. This study follows this change in policy, isolating and analyzing the principal factors in policy formulation.

The failure of the multilateral approach to Korean

reconstruction stemmed, in large part, from the failure of the United States government to relate its policy on Korean relief and reconstruction to American objectives in the Far East. For in the summer of 1951, when military goals had been deliberately limited and the moment for supporting UNKRA was crucial and vital, the United States government, following the advice of military leaders and bowing to the pressures of domestic politics, took a narrow approach to the problem and lost an opportunity to strengthen the United Nations not only in Korea, but in all of Asia. As a result, the United States missed an almost unique chance to surge forward in the struggle for the mind of Asia.

By the time the Armistice Agreement was signed in Korea in 1953, there were almost insurmountable barriers to the reinvigoration of a multilateral aid program no matter what advantages such a policy might have held for furthering American interests. A large South Korean Army had been trained and equipped; Syngman Rhee held an incredibly strong bargaining position with the United States; and American public opinion was clamoring for the return of American troops from Korea. These were powerful and unrelenting pressures for a bilateral program of defense support for the Republic of Korea. The multilateral policy had to give way.

Microfilm $5.00; Xerox $16.80. 392 pages.

SOVIET POLICY IN WESTERN EUROPE AND THE FRENCH COMMUNIST PARTY, 1949-1952

(L. C. Card No. Mic 59-3056)

Marshall Darrow Shulman, Ph.D.
Columbia University, 1959

A pattern of alternation between periods of advance and periods of consolidation has characterized Soviet foreign policy. Although the death of Stalin is often emphasized as a decisive factor in the determination of recent Soviet policy, it can be shown that important changes in the Soviet outlook and in Soviet behavior abroad, leading to a consolidation (or "Right-wing") phase of policy, took place before the death of Stalin. Although both internal and external factors may have been responsible for this shift, the primary consideration appears to have been a response on the part of the Soviet leadership to changes in world power relationships.

The period of militant advance in Soviet policy from 1947 to 1949, associated with the Soviet effort to redefine the outer periphery of its sphere of interest in the molten power situation following the war, had stimulated the Western powers to increase their military capabilities. Following the failure of the Berlin blockade, the last and climactic act of this period of militant Communist probing in Western Europe, the Soviet Union began to seek to reverse the adverse trend in its world power position by moving toward a "Right-wing" policy -- a less overtly bellicose course of action, seeking to take advantage of political and economic opportunities within a general atmosphere of relaxation of international tension.

This change of emphasis in Soviet policy came into being during a period of transition and experimentation from 1949 to 1952, when it was formally sanctioned at the XIX Congress of the Communist Party of the Soviet Union. In the meantime, the mixture of policies which characterized Soviet behavior in this period was unsuccessful in preventing the signing of the North Atlantic Treaty and the establishment of a West German Government, as well as the signing of the Bonn and Paris Treaties in 1952 which looked toward the inclusion of a West German military contribution to the Western alliance. On the other hand, Soviet power was strengthened in this period by the development of the Soviet atomic weapon, the growth of neutralism and pacifism in the non-Communist world, and the Communist victory in China. The latter gain, which signified a dynamic phase in the revolutionary movement in Asia at the same time as the European continent appeared to have reached a stage of provisional stabilization, led to a period of differentiation in Communist policy; efforts toward an atmosphere of détente in Europe were accompanied by a continued militancy in Asia. The contradictory force of these policies became evident following the Communist attack in Korea, which further stimulated the mobilization and cohesion of the Western powers.

A study of the operational experiences of the French Communist Party during this period illuminates the experimentation and the conflict between opposing tendencies within the Communist movement abroad which preceded the formulation of the line of the XIX Congress. Militant strikes and sectarian tactics had led to the political isolation of the Communists in France. In order to reverse the orientation of the French government towards the Western military alliance, the Communists found it necessary to overcome their political isolation by striving for a broad alliance with elements of the bourgeoisie in France. This broad-front policy, which utilized the Peace Movement as an important instrumentality, in turn obliged the Communist leaders to modify, at least for the time being, ideological emphasis upon the class struggle against the bourgeoisie and against nationalism in the Western world. It is this experience which helps to explain the significance of the doctrines enunciated at the XIX Congress in October 1952.

Microfilm $4.65; Xerox $15.60. 362 pages.

ORIGINS OF THE KEMALIST MOVEMENT AND THE GOVERNMENT OF THE GRAND NATIONAL ASSEMBLY (1919-1923)

(L. C. Card No. Mic 59-2975)

Elaine Diana Smith, Ph.D.
The American University, 1959

This study deals primarily with the non-military aspects of the Kemalist Movement from 1919 to 1923. The narrative explains how a smaller but more united Turkish Republic emerged from the ruins of the Ottoman Empire through the struggle for independence.

An examination of the sources pertaining to the establishment of the Turkish Grand National Assembly reveals the predominant role of Mustafa Kemal Atatürk as the moving spirit of the Turkish Revolution. The genius of Atatürk transformed the spontaneous but disorganized "Defense of Rights" nationalist resistance groups into an effective institution, the Government of the Grand National Assembly in Ankara, which conducted a war against the

foreign invaders, devised methods of dealing with political groupings in Anatolia, and dealt with problems arising from the existence of a rival government in Istanbul.

Recent Turkish scholarship, however, reveals that the role played by other Turkish nationalist leaders during this period is perhaps more important than has hitherto been realized. This includes the contributions of both the leaders who supported Atatürk such as Ismet Pasha and Fevzi Pasha, and of other leaders such as Rauf Bey, Ali Fuat Cebesoy, Refet Pasha and Kazim Karabekir who while supporting Atatürk's aims opposed what they regarded as his authoritarian methods.

The strong leadership of Atatürk was able to overcome the existing inertia and the divisive forces inherited from the Ottoman Empire, since Turkey then lacked long-established secular stabilizing institutions, and was only superficially influenced by Western ideas.

Despite the continuous wars that had sapped the strength of Turkey since 1911, and the foreign occupation of a large portion of the country, Atatürk's military genius was able to forge a victorious army out of the remnants of the Ottoman army and the irregular guerilla forces. The success of the Turkish army was due to the Turkish military tradition and the experience and ability of Turkish military leaders. Turkish military achievements were paralleled in the diplomatic field because of long experience and favorable external circumstances.

The British, French, and Italian rivalries gave the Kemalist policy makers an opportunity to drive a diplomatic wedge which finally isolated Britain from her allies. The United States was generally friendly to the Kemalist cause. The errors of the Greek leadership in part neutralized the Greek superiority in numbers and equipment. Also, the Bolshevik Revolution had weakened Turkey's traditional enemy, and a temporary coincidence of interests made the new Soviet Government assume a more friendly policy toward the Kemalists. Turkish historians, while stressing the ulterior motives of the Soviets and the fact that the Soviet aid to Ankara was small, admit that Soviet diplomatic support at this time was crucial.

Despite the West's initially unfriendly policy toward the Kemalists, Turkey's fundamental nationalist ideals inspired by the French Revolution, developed by the Young Turks, and formulated by Ziya Gökalp in his concept of Turkism, rejected Soviet Russia's Communist ideology even from the earliest days. Instead, the Kemalists attempted to settle their differences with the West at the 1923 Lausanne Conference and soon thereafter adopted a policy of modernization along Western lines.

Probably the most significant concept that developed in these formative years of the new Turkey was the doctrine of "National Sovereignty" as formulated in the National Pact of 1920. This Kemalist ideology rejected foreign control, instilled a new spirit in the thinking of the people, and gave direction to Turkish domestic and foreign policy which has basically continued to this day, making Turkey a stable and useful member of the Free World community.

Microfilm $3.10; Xerox $10.60. 237 pages.

PAKISTAN'S NORTH-WEST FRONTIER: POLITICAL PROBLEMS OF A BORDERLAND

(L. C. Card No. Mic 59-2600)

James W. Spain, Ph.D.
Columbia University, 1959

This dissertation of approximately 100,000 words is primarily a social and political history of the Pukhtun tribes who live along Pakistan's North-West Frontier. The work draws on documents in the India Office Library and Public Record Office in London, Pakistani Government archives, several American libraries, and the field work of the author during several prolonged visits to the Frontier area from 1951 to 1954.

Introductory chapters describe the rugged country below the western end of the Himalaya Mountains in which the Pukhtuns dwell, sketch the early history of the tribes, and outline the origin and characteristics of the various clans. Considerable data is presented on the Pukhtun land tenure system and on such traditional institutions as Pukhtunwali (the Pukhtun code), the jirga (assembly), the lashkar (war party), the malik (chieftain), the mullah (priest), and the huira (guest house). Pukhtun language and literature, including the works of Khushal Khan Khattak, are also discussed.

The bulk of the study is devoted to events since the coming of the British to the Pukhtun area in 1849. British administration of the Frontier in the nineteenth and twentieth centuries is considered in separate chapters with emphasis on institutions peculiar to the Frontier such as the Frontier Crimes Regulations. There are chapters on the Frontier's relations with other parts of British India, the Pukhtuns' long history of revolt against British rule, and the reasons for this revolt. The "Great Game" between Czarist Russia and Great Britain in the nineteenth century is treated in detail insofar as it affected the Frontier.

A chapter is devoted to events immediately before, during, and after the partition of British India in 1947. The Pukhtun lashkar into Kashmir in 1947-48 is given special attention. A succeeding chapter discusses the problems Pakistan has encountered in attempting to assimilate the Frontier into its national life and the progress which has been made. The important role played by Khan Abdul Qaiyum Khan, first chief minister of the Frontier Province under Pakistan, is described.

Afghanistan's interest in the Pukhtun area is considered from historical, legal, and political viewpoints. The "Pukhtunistan" movement and the motivations behind it are treated in some detail. There is a description of the movement's organization and leadership in Afghanistan.

The final chapter deals with the continuation of the "Great Game" between the Soviet Union and Britain after World War I and with the conflicting international pressures brought to bear upon the area after World War II and the departure of the British.

There is a selected bibliography of about 300 entries and a specially-prepared map of the Frontier area showing political divisions, tribal distribution, and the Pushtu-speaking area.

Microfilm $5.75; Xerox $20.20. 452 pages.

POLITICAL SCIENCE, PUBLIC ADMINISTRATION

JUDICIAL REVIEW OF CONGRESSIONAL INVESTIGATIVE POWERS WITH SPECIAL REFERENCE TO THE PERIOD 1945-1957

(L. C. Card No. Mic 59-2832)

William Henry Brown, Ph.D.
The American University, 1959

Introduction. The inquiries conducted by congressional investigatory committees during the period 1945 to 1957 increased in number and diversity of subjects examined as compared with prior years. This increased activity resulted in a large number of judicial proceedings coming before the federal courts as the result of the indictment of witnesses for contempt of Congress by reason of their refusal to appear when summoned, to be sworn, to testify, to produce subpoenaed documents and records, and other contumacious acts. These judicial proceedings also brought into question such matters as the legality of the statutes and resolutions which had authorized certain investigations, infringements upon the protective provisions of the Bill of Rights, the manner in which investigations had been conducted in specific instances, and other matters.

Problem. The problem of this dissertation is to analyze the federal court decisions rendered during the period under review for the purpose of ascertaining the nature of and reasons for the opinions which upheld congressional investigatory hearings, particularly from the standpoint of authority and procedures, or which, on the other hand, sustained the contentions asserted by witness-defendants in opposition to such inquiries and the manner in which they had been conducted. The information thus obtained would make possible a determination of the corrective steps that should be taken to improve and insure the effective functioning of congressional investigatory powers and committees.

Method of research. To accomplish the above-mentioned purposes resort was made to the history of congressional investigations from early times down to date as set forth in scholarly works, articles on this subject which appeared in national government publications, legal periodicals, and newspapers. Thereupon, the federal court opinions relative to the 146 separate proceedings which had developed as the result of congressional investigatory committee hearings during the 1945 to 1957 period, were reviewed and analyzed for the purpose of determining the legal principles involved in these judicial proceedings and which established the bases for the decisions of the courts.

A brief description of each court case reviewed has been presented for the purpose of identifying the litigants and legal issues involved. In addition, the proceedings reviewed have been summarized as regards each federal court--District Court, Court of Appeals, and Supreme Court of the United States--and the nature of the decisions whether favorable or unfavorable to the Government.

Results attained. The legal principles expressed by the courts in their decisions have been set forth and discussed with respect to such subjects as the authority of committees, membership of investigatory committees, resolutions authorizing congressional investigations, quorum requirements, resort by witnesses to the protection and privileges guaranteed by the Bill of Rights, and numerous other matters. These subjects have been set forth in separate sections with respect to the decisions and expressions of principles which were favorable to the Government and those that were unfavorable.

The information obtained by these methods permitted a summarization to be made of the results attained by congressional investigatory committees, and the detriments to which they have been subjected by court decisions.

Conclusions and recommendations. This review of judicial decisions clearly showed the need for uniform rules of procedure for the control and guidance of congressional investigatory committees and witnesses. Within recent years, both Houses of Congress have had reports prepared concerning this matter, but no action has been taken thereon by the Senate. The House of Representatives, in March 1955, adopted certain uniform rules of procedure which do not meet necessary requirements. Accordingly, the recommendation is made that comprehensive uniform rules of procedure be adopted and put into effect by the Senate and House of Representatives.

Microfilm $7.35; Xerox $25.20. 579 pages.

THE COLLEGE ADMINISTRATION AND FACULTY: A STUDY OF ADMINISTRATIVE FUNCTIONS AND ROLES

(L. C. Card No. Mic 59-2613)

K. William Leffland, D.P.A.
University of Southern California, 1959

Chairman: Professor John M. Pfiffner

Participative or "bottom-up" management theory leaves unanswered some basic questions: Are the members of organizations aware of nonparticipation when that condition exists? Are they interested in increased participation? Would they be qualified to participate if the opportunity were afforded? The purpose of this study was to shed some light on these questions, using six colleges as the organizational reference. Since colleges and universities have participative antecedents as well as a tradition of academic freedom and since the college faculty comprises a "worker" group of scholars and experts, this form of organization appeared to supply an excellent basis for research on these questions.

The study analyzed the formally described, the actual, and the expressly desired administrative roles of the faculties and administrative staffs of six colleges representing state, private, and church-controlled institutions. The research involved a questionnaire and interview pattern which included all officers and faculties of the colleges studied. The questionnaire results were measured for statistical significance by the chi-square analysis technique.

Hypotheses and Findings. Three hypotheses were tested and substantially upheld. The majority of professors indicated desires for increased consultative roles, rather than decision-making powers, in college government. They further appeared to be primarily interested in being consulted on important college policies, problems, and issues, rather than on more routine administrative matters.

The initial hypothesis maintained college professors to be generally dissatisfied with existing divisions between their academic roles and the administrative controls

exercised by presidents and officers of the colleges studied The administrative officers were assumed to oppose any substantial increase in faculty participation in college government, and the faculties were thought to desire increased roles in the guidance, development, and control of their institutions. In this sense a conflict was found to exist between the two groups.

The second hypothesis asserted the colleges to be organized as corporate-type structures with a traditional hierarchy of superior-subordinate relationships, encompassing faculty as well as administrative officers and personnel. Research showed that, although most administrators and faculties thought their colleges to be "communities of scholars," they also thought their presidents considered them as "employees" of the institutions. Administrators did not object to this classification, but professors did. A general trend of hierarchical division and faculty isolation from the administrative decision-making process was found in most colleges, especially beyond the division levels.

Hypothesis three considered the administrative officers and faculties of the state, private, and church-controlled colleges to be basically similar in their desired administrative roles. Analysis indicated that, even though the private and church-controlled colleges had more local autonomy of operation than the state colleges, and relatively more faculty participation in several areas of administration, the faculties of all colleges generally shared the same aspiration of an increased consultative role. The administrative officers, on the other hand, consistently favored the administrative status quo and opposed any substantial increase in faculty participation in college government.

Conclusions. The findings indicate that in the colleges studied there is a distinct awareness by academic personnel of nonparticipation in many administrative actions vital to the welfare and work of the professorial group. The faculties showed a marked interest in increased participation in the major policy decision areas, rather than in routine administrative matters. They appeared to be concerned over problems associated with major policy decisions, particularly involving policy planning, curriculum planning and development, and actions affecting academic appointments, tenure, promotions, and discharge. There was some evidence that both administrators and faculty people would need training in terms of attitudes and skills before effective change could be made.

Microfilm $4.65; Xerox $15.60. 363 pages.

POLITICS OF DEFERENCE: A STUDY OF THE POLITICAL STRUCTURE, LEADERSHIP, AND ORGANIZATION OF ENGLISH COUNTY CONSTITUENCIES IN THE NINETEENTH CENTURY

(L. C. Card No. Mic 59-737)

David Cresap Moore, Ph.D.
Columbia University, 1958

In analyzing the mid-nineteenth century structure of English counties extensive use has been made of poll books, records available for most constituencies for the period before the Ballot Act of 1872 of the votes cast by each elector at each contested election. Indicating the composition of the various electoral groups within a constituency, poll books reflect the local factors of power and illustrate the changes wrought by the first two English Reform Acts. They also illuminate certain general problems of parliamentary politics.

Before the first Reform Act, when many boroughs provided seats for Government supporters, the counties were a bastion of "independence." This was a consequence of the Government's role as dispenser of public funds and the social structure of the counties. Most landowners' primary orientations were local. Through their near-absolute influence over the votes of their dependents they managed county elections to suit themselves.

Before 1832, however, most county electors were urban, not rural. While the 40s. freehold remained effectively the sole county franchise qualification the relatively high division of property ownership in urban areas gave to these a potentially dominant electoral weight. Before 1830 this weight was never used coherently. In the latter 1820's, however, urban leaders coalesced. Profitting from the large electoral weight of the county areas susceptible to their influence-- an influence comparable to that of the rural landowners elsewhere-- these urban leaders returned the margin of members to Parliament who passed the Reform Act.

In disfranchising many corrupt boroughs the first Reform Act precluded the Government from creating parliamentary majorities at their source. While many landowners approved of this they were generally hostile to Reform, fearing it would increase the powers of the urban interests. Paradoxically, the Act itself did not do so. In spite of the new £10 franchise in the boroughs many boroughs remained proprietary. In the counties the enfranchising provisions of the Act increased the relative electoral weight of the rural areas. By assigning seats to certain previously unrepresented towns, and by decreeing that no person might vote in a county in respect of property entitling him to vote in a borough, the Act reduced the electoral weight of the urban areas of the counties. Further, the number of new county seats almost equalled the number of new borough seats. The Act did much to restore the political powers of the gentry and aristocracy from their nadir of 1831.

From the 1830's until the 1870's the personal preferences of local landowners were the primary factors in the politics of most counties. Many boroughs were similarly oligarchical. The powers of these magnates precluded the growth of coherent political parties focussed on Parliament.

The collapse of this structure in the counties occurred primarily as a result of the spread of "high farming" and changes in the nature of the county electorates. Until 1846 the social structure of the counties was shielded from the subversive implications of capitalized agriculture, the sole alternative to protection. Appealing to both landowner and tenant, protection contributed to the local political influence of the former. While the exigencies of capitalized agriculture drove a wedge between these two groups, landowners' powers were also undermined by the growth of suburbs and the reintroduction of urban elements into the counties. The redrawing of borough boundaries in 1867 delayed the growth of heterogeneous county electorates. However, the process contined and was legally confirmed by the Redistribution Act of 1885. Concomitant with the declining influence of local leaders centralized parties became established which sought to appeal to electors directly, and which were oriented towards the politics of social reform.

Microfilm $8.60; Xerox $30.60. 680 pages.

BACKGROUND AND DEVELOPMENT OF PHILIPPINE ADMINISTRATIVE LAW

(L. C. Card No. Mic 59-1204)

Ramon Camaclan Portugal, Ph.D.
Syracuse University, 1958

Statement of the Problem

Philippine political history shows that as a result of the American regime in the country (1898-1935), American concepts and institutions in government and public administration have been transplanted into Philippine soil. The setting, however, is not quite the same because of a different kind of Philippine society, characterized, among other things, by a paternal type of government.

The Philippines has run with the current of the development of the service state, producing its administrative law patterned after the American prototype. In the light of the current thinking and emerging trends in the field, the dominant features and possible shortcomings of Philippine administrative law are considered in this paper.

Procedure of Study

The study is divided into the three major parts of administrative law, namely: (1) problems arising out of the position of administrative agencies in the constitutional system of government, (2) procedures governing the agencies in the transaction of business, and (3) judicial review of administrative action. That more and more attention is being focused lately on the procedural aspect of the law is given proper recognition. Also, because of its bearing on individual rights, the topic of state immunity and official liability is included in the discussion.

Philippine laws, adjudicated cases, and other materials are availed of to picture the present state of the law. References to the writings of commentators and reports of bodies informed on problems in administrative law are included to present points of view aimed at improving the administrative process.

Conclusions

Environment exerts a great influence on a country's governmental administration, and Philippine administrative law responds to the needs of Philippine society. The Philippines purports to be democratic, in the Western sense of the word, and the protection of individual rights against unwarranted governmental restraints should be a primary concern of the state. At the same time, government must be effective in the prosecution of the public purposes.

Set against this background, the study reveals the need for more informal procedures and less formality in administrative proceedings so as to achieve the values set by administrative law. There should be more consultation, and adequate information and publicity in the formulation and execution of administrative rules and regulations. The creation of a central office to coordinate the work of the various administrative agencies is suggested. This office would take care of information and publicity requirements as well as provide the initiative for organized effort at procedural improvement. The enactment of an administrative procedure act, patterned after the Model State Procedure Act, is offered as a possibility. This legislation might take care of certain fundamental requirements in the administrative process without hurting flexibility or putting the administrative agencies in a strait jacket.

A relaxation of the doctrine of sovereign immunity and greater government responsibility for certain tortious acts of public officials and employees might make for more effective administration. Greater respect for the law by the governor is required if compliance by the governed is expected. A crying need is the elevation of official morality and the stamping out of corruption in the government. In short, the maintenance of an efficient and honest government is crucial to the preservation of the democratic experiment in the Philippines.

Microfilm $5.80; Xerox $20.20. 453 pages.

PSYCHOLOGY

PSYCHOLOGY, GENERAL

A DEVELOPMENTAL STUDY OF ADOLESCENT NEEDS AS THEY ARE MANIFESTED IN VARIOUS ENVIRONMENTAL SITUATIONS

(L. C. Card No. Mic 59-2706)

Murray Benimoff, Ph.D.
The Ohio State University, 1954

The dissertation is a study of the development of the adolescent needs manifested by groups of youth categorized by age, intelligence, sex, grade placement, and social class.

Twelve needs have been investigated in this study: (1) acceptance, (2), achievement, (3) affection, (4) approval, (5) belonging, (6) conformity, (7) dependence, (8) independence, (9) mastery-dominance, (10) recognition, (11) self-realization, and (12) sympathetic understanding. Each of these twelve needs were considered in different situations: (1) in unisexual peer groups, (2) in heterosexual peer groups, (3) in unisexual pairs, (4) in heterosexual pairs, (5) in family groups, (6) in school, (7) in adult relation and (8) in relation to the self.

The present study attempted to answer four questions, the first of which was the central point of interest. The four questions or problems are as follows:

1. What changes take place during adolescence in need-satisfaction versus need-nonsatisfaction as the needs are manifested in various environmental situations?

2. Where are the crucial areas of equilibrium-disequilibrium that can be of use for both the teacher and the psychologist?
3. What hypotheses develop from the data for testing with future samples?
4. What suggestions can be derived regarding variables which may prove of better research value?

A 90-item needs questionnaire was administered to a selected sample of 200 youth enrolled in Willis High School located in Delaware, Ohio. The questionnaire consisted of a series of statements referring to twelve specific psychological needs, each of which operated in eight "environmental" situations. Each item or statement thus represented both a needs category and an environmental situation. Each item was so constructed that it was possible to represent the problems of goal-setting and goal-achievement. A scoring device was used which indicated the relative success of an adolescent in achieving his goal in a specific needs category within a specific environmental situation. The adolescent's success was relative to the success of the total sample; that is, when he was as successful as the upper half of the sample in a needs category or environmental situation, he was conceived of as being in "equilibrium" in that needs category or environmental situation. When, however, the youth fell in the lower half of the sample in success of achieving a goal, he was considered in "disequilibrium" in the needs category or environmental situation.

The youths' responses were analyzed for statistically significant differences in equilibrium-disequilibrium among the five sampling variables--sex, intelligence, social class, age, and grade. This analysis was performed at three levels for the environmental situations and the needs categories. The first level of analysis consisted of comparing the single sampling variables with the criterion of equilibrium-disequilibrium on each of the environmental situations and each of the needs categories. The second level of analysis consisted of determining the relationship between the criterion of equilibrium-disequilibrium with the double-sampling combinations, that is, two sampling variables at a time. The third level of analysis consisted of determining which sub-groups of the double-sampling combinations were contributing to the significance of difference obtained at the second level of analysis. The chi-square test of significance of difference was used at each of the three levels of analysis. Finally, a frequency tabulation was made of the number of times a sampling variable, alone or in combination, produced a significant result.

Conclusions

1. Environmental Situations

a. School

The variables of below-average intelligence, lower social class, female sex, and presence in a lower grade were most frequently associated with disequilibrium within the school situation. Girls of below-average intelligence particularly were associated with disequilibrium within this environmental situation. There was a developmental trend for the average intelligence group to develop from disequilibrium at the early grades to equilibrium at the upper grades. The below-average intelligence students had disequilibrium in all the grades, whereas the above-average intelligence group had either equilibrium or equal status throughout the grade range.

b. Adults

The strongest relationships which appeared in the environmental situation of adults was the developmental trend for all three categories of social class to have an increase in equilibrium with increasing age and increasing grade. The upper social class group obtained a sufficient amount of need-satisfaction throughout the age and grade span covered in this study. There was a strong relationship for the middle social class students to be in disequilibrium from ages 11-15 and grades 8-9. The lower social class group also experienced slight disequilibrium at the younger ages and from grades 9-10 but this relationship was not as strong for the lower as it was for the middle social class group. There was a tendency for students who were placed below grade to be in disequilibrium, whereas the group who were correctly placed for age were in equilibrium throughout the age-grade span. The former relationship of disequilibrium in the students who were placed below-grade was strongest at age 16. As far as intelligence is concerned the trend was for the average intelligence group to be in disequilibrium at the lower grades and to change to a relatively equal status or equilibrium at the middle or upper grades. Finally, there was a developmental trend for equilibrium or equal status at the extremes of the age span and disequilibrium at the middle ages.

c. Heterosexual Peer Group

The variables of age, grade, and social class had the strongest relationship to equilibrium-disequilibrium within the environmental situation of the heterosexual peer group. The strongest relationship appeared in the upper social class group which was in equilibrium at the younger ages, changed to disequilibrium during the middle ages, and was stablilzed at a fairly equal status at the older ages. An equally strong relationship was seen in the lower social class group which was in disequilibrium at the lower ages, developed to equal status at the middle ages, and changed to equilibrium at the older ages. The relationship for the middle social class group was not as strong as it was for the other two social class groups; however, the middle social class group showed the developmental trend of equilibrium at both middle and older ages. As far as social class and grade is concerned the strongest relationship existed for the upper social class group, which showed a sufficient amount of need-satisfaction at the extremes of the grade span and disequilibrium during the middle grades. The strongest relationship for age-grade categories existed at age 14 and 15, when students who were placed below grade had more equilibrium and students who were correctly placed had more equilibrium.

d. Unisexual Pairs

In the environmental situation of unisexual pairs there was much more disequilibrium in boys than in girls. The only other significant sampling variable was the age-grade combination. Thus there was a developmental trend toward greater equilibrium with increasing age both in students who were correctly placed and in students who were placed below grade. The strongest single relationship in the age-grade combination was at ages 14 and 15, when there was more equilibrium in students placed below grade than in students who were correctly placed.

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e. Heterosexual Pairs

In the environmental situation of heterosexual pairs there was a trend for equilibrium at the middle ages of 14 and 15. The relationship was particularly strong for the upper social class group, which showed equilibrium at the younger ages, disequilibrium during the middle ages, and equilibrium at the older ages.

f. Family Group

The strongest relationships present in the environmental situation of the family group appeared for students of below-average intelligence, particularly girls, and either upper or middle social class groups; these relationships showed disequilibrium. However, students of below-average intelligence and lower social class showed equilibrium in the family group. Boys, average, and above-average intelligence groups did not reveal any significant relationships in this environmental situation.

2. Needs Categories

a. Achievement

In this needs category there was a general trend for boys to be in more disequilibrium than girls. Girls of all three levels of social class showed either equilibrium or equal status. On the other hand, boys of both the upper and lower social class showed disequilibrium, and boys of the middle social class showed relatively equal status. A more refined relationship appeared in the developmental pattern for age in the sense that boys showed diseqilibrium at the middle ages and relatively equal status at either extreme of the age span. Girls in the age span presented equilibrium until age 15, when there was a change toward slight disequilibrium, which continued to the end of the age span.

b. Self-Realization

The trend in the needs category of self-realization was one in which girls of all three groups of social class showed either equal status or equilibrium. On the other hand, there was a very strong relationship for boys of upper social class to show disequilibrium, whereas boys of both middle and lower social class showed either equal status or more equilibrium.

c. Dependence

Generally speaking, there was a trend in development during the grades for either equal status or equilibrium at all the grades with the exception of grade 8, where disequilibrium was present. Boys showed a sufficient amount of need-satisfaction at either extreme of the age span but had disequilibrium at the middle ages. The girls' responses were extremely variable with age in the sense that they began with equilibrium at the youngest age, and ended up with disequilibrium at ages 17-19.

d. Mastery-Dominance

There was an over-all trend for disequilibrium in boys and equilibrium in girls in the needs category of mastery-dominance. There was, furthermore, a trend for either equal status or equilibrium at the extremes of the grade span and disequilibrium at grades 8-11. Girls, on the other hand, showed sufficient need-satisfaction throughout the age span with the exception of slight disequilibrium at age 10.

e. Sympathetic Understanding

In the needs category of sympathetic understanding the only significant relationships occurred with the double-sampling combination of intelligence and social class. In both upper and middle social class groups there was sufficient need-satisfaction, but in the below-average intelligence group of the lower social class group, there was disequilibrium. In the above-average intelligence group there was disequilibrium in the middle social class group and sufficient need-satisfactions for both upper and lower social class groups. The average intelligence group failed to produce significant relationships in this need category.

f. Belonging

In the needs category of belonging the only significant relationship appeared with the double-sampling combination of intelligence and grade. The below-average intelligence group had equilibrium in the lower grades and changed to disequilibrium at the upper grades. The average and above-average intelligence groups failed to demonstrate significant relationships in the grade span.

g. Approval

In the needs category of approval there was a developmental trend for lower social class students to have disequilibrium at the early and middle ages; this trend changed to equilibrium at the older ages. The upper and middle social class groups failed to produce any significant relationships in the age span. At age 13, students who were placed below grade had more disequilibrium than students who were correctly placed. All other combinations of age and grade failed to produce significant relationships.

It was also concluded that sex as a sampling variable had the most research value in the present study. Grade and age were comparatively less important than sex. Intelligence and social class had the least value.

Discussion

One of the more important findings of the present study was the general developmental trend for youths to experience varying amounts of disequilibrium during the middle ages and middle grades of high school. There was a decided trend for equilibrium or greater need-satisfaction to occur at either end of the age and grade span. It would seem that the concepts of environmental demands, psychological needs, and skill in learning new tasks could account for this phenomenon. That is to say, when the youth is pre-adolescent, from about ages 11 to 13 and grades 7 to 8, the demands of the situations which he meets are such that the childhood pattern of behavior may still be successful in achieving basic need-satisfactions. It is not unlikely that the environmental situation in which the pre-adolescent finds himself may actually foster this childhood pattern during this period. Take for example the environmental situation of heterosexual pairs. During pre-adolescence the youth may reject intimate associations with the opposite sex and still be satisfying his own needs and environmental pressures. However, upon entrance into adolescence (puberty) he experiences changes in his needs and his peer culture may demand that he become more skillful and resourceful with members of the opposite sex. Until he reaches the point where he can truly be skillful in his relationships with the opposite sex,

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the youth tends to be in a state of more or less need-nonsatisfaction. When those skills which are necessary for adjustment to various situations have been learned, the adolescent is capable of meeting the demands of his own needs and those of environmental situations. This situation of need-satisfaction thus appears to be fairly well established after age 16 and around the tenth grade. The writer does not mean to indicate that all adolescents used in the present study possess complete need-satisfactions after the aforementioned age and grade; there are always, of course, individual differences.

Another concept used to explain some findings is that of social reward. This can be illustrated by the fact that below-average intelligence and lower social class youngsters had greater disequilibrium within the school. The point has been made that a goodly portion of the teachers of our public schools come from the middle social class. These teachers have grown up and have learned the values, attitudes, etc., of their class. Within the school situation the teacher can be a mediator of rewards or punishments. He can be intrinsically involved in whether a school child achieves success or experiences failure. It would seem, then, that as far as the present study is concerned these teachers are either not rewarding students or not constructing situations in which success can take place for the below-average intelligence and lower social class youngster. With the failure to obtain sufficient need-satisfactions this kind of youth apparently perceives the school as a situation of disequilibrium for him.

In the needs categories of achievement and mastery-dominance it was found, generally, that girls had greater equilibrium than boys. Thus, generally speaking, it seems as if girls are better able to obtain need-satisfactions, particularly in these two needs areas. The concepts of social role and opportunity to experience success may be relevant here. Apparently boys may experience a change in their social role as they progress from pre-adolescence through puberty. Girls may not experience a drastic change in their social roles. Girls may also experience more success than boys for their achievement needs, especially if teachers and others tend to react more favorably to them. Thus boys are presented with the added adjustment problem of a changing social role (from the dependent childish role to the dominant male adult role) and lack the background of experience necessary for knowing how to react to a newer role. Thus, again, until boys learn social skills which will make them more effective in achieving status, they will apparently experience disequilibrium of needs of achievement and mastery-dominance.

Another point that could be made here is the fact that there was, generally speaking, a lack of a linear relation between the sampling variables and equilibrium-disequilibrium within any of the environmental situations or needs categories. Rather, it was found that a relationship would exist for one or two categories of a sampling variable and the criterion of equilibrium-disequilibrium. Apparently a qualitative change takes place in need-satisfaction and need-nonsatisfaction as one progresses through a sampling variable within any specific area. The effect of this process is that one cannot predict greater or lesser equilibrium or disequilibrium within varying degrees of a sampling variable by shere knowledge of the extent of equilibrium or disequilibrium in one category of the sampling variable.

Finally, the fact that sex, age, and grade produced more significant results may be explained on the grounds that culture demands different development tasks from different sex groups and different age groups.

Microfilm $2.25; Xerox $8.00. 171 pages.

Abstract published by special arrangement with The Ohio State University.

A FACTORIAL STUDY OF THE ITEMS IN A MATHEMATICS PLACEMENT TEST

(L. C. Card No. Mic 59-2545)

William Allen Brett, Ph.D.
The Ohio State University, 1954

A complete factor analysis of the items of the Ohio State University Mathematics Placement Test, Form D, was undertaken in order to: (1) sort out the items into groups which appeared to measure the same types of mathematical ability; (2) assess the utility of each item as a predictor of success in a mathematics course (Mathematics 416); (3) seek implications as to the prospects for success of a "nonmathematical" or "training-free" prognostic test of mathematical aptitude.

The over-all purpose was to obtain information useful in a pending revision of the test.

The population used in the study consisted of all students taking Mathematics 416 during the Autumn Quarter of 1953 at the Ohio State University, for whom score sheets on the placement test were obtainable; these yielded an N of 217.

The pass or fail scores on each item were recorded on an IBM card for each student as punched or not punched respectively, and the cards were sorted to obtain proportions from which tetrachoric correlation coefficients between each item and all the other items could be obtained.

The resulting matrix of item intercorrelations (39 x 39) was then factor analyzed by the multiple group method. Twelve group factors and a general factor were extracted in explaining this matrix. The factors were converted to orthogonality, rotated for meaningfulness, and identified.

The three criterion variables were scores on an early October midterm examination, a late November midterm examination, and the final examination. The total score on the Ohio State Psychological Examination (OSPE) was also added to obtain information useful in interpreting the general factor. Each set of scores was split into upper and lower values punched into the cards. The necessary additional sorts were made to obtain frequencies, and inter-item correlations were computed.

The additional variables were added to the factor matrix by an iterative process, and a final residual table was calculated.

The last step consisted of interpreting the general factor and assessing the utility of each item in the light of the criterion variables.

Conclusions

1. The general factor appears to involve memory for rules and principles rather than to involve general ability.

2. Since the general factor was for all practical purposes the only factor on which the criterion variables had significant loadings, the utility of an item as a predictor of success in Mathematics 416 can be estimated from the size of its loading on this factor.

3. In this light, the items which measure certain probably overlearned arithmetic processes appear to be poor predictors of success in Mathematics 416. The clearest examples of this type of item are found in the case of decimal division and decimal multiplication.

4. On the other hand, the items identified with factors D (Exponents) and L (Factoring) tended to be uniformly strong as predictors. This type of item might be given more prominence in any revision of the test, at least in so far as improved prediction of success in Mathematics 416 is desired.

5. With regard to the third of the purposes of the research, the evidence, so far as it goes, does not augur well for the construction of a nonmathematical prognostic test of mathematical ability. This is because factors emerged as quite specifically related to operations in mathematics rather than to underlying psychological abilities. Microfilm $2.00; Xerox $3.00. 59 pages.

Abstract published by special arrangement with The Ohio State University.

MORALE SCALES, SOCIOMETRIC CHOICES, AND PRODUCTIVITY OF INDUSTRIAL WORK TEAMS

(L. C. Card No. Mic 59-2877)

Ronald Edward Casey, Ph.D.
The Pennsylvania State University, 1959

Statement of the Problem and Hypotheses

The bulk of empirical evidence fails to support an appreciable relationship between industrial morale and worker performance. A serious limitation to much attitude and morale measurement is a reliance on multidimensional measuring instruments involving more than one continuum. This permits the grouping of multiple effects and encourages the possibility of obscuring a real relationship between productivity and one or more individually introduced components of morale. Another limitation is the failure to make an experimental distinction between the liking and the striving aspects of morale. The liking component has to do with how much an individual likes a situation. The striving aspect is concerned with how hard he is willing to strive to do a good job in the work situation.

The Major Hypotheses:

1. Striving morale, in one or both of its aspects, is correlated with productivity.

2. Liking morale and striving morale are differentially related to productivity.

3. A combination of striving and liking morale better predicts productivity than either is able to do separately.

The nature of the research setting at the Owens-Corning Fiberglas Corporation of Huntingdon, Pennsylvania, consisted of work teams composed of two workers each. The organization of work partner teams in relation to partner preference was investigated.

The Subsidiary Hypotheses:

4. Team cohesiveness, as expressed by partner satisfaction, is positively related to team productivity.

5. Cohesive work teams are characterized by higher morale scores than are less cohesive work teams.

Procedures

The criterion consisted of average team productivity. In a test of the odd-even reliability of the criterion a Pearson product-moment correlation of .94 resulted. The following nine unidimensional scales of liking morale, previously developed by Stover and McNiven, were adopted for use: Work environment, wages and benefits, employee-supervisor relations, competence and sincerity of management, friendliness of fellow workers, personal satisfaction and recognition, job security, communication-- employees to management, and communication-- management to employees. Two striving scales designed to measure striving for productivity and striving for company goals were devised by the author. All scales were developed and tested for scalability and unidimensionality by means of the Guttman scalogram analysis. All but the last named scale achieved satisfactory levels of reproducibility. It did however achieve the status of a quasi-scale and thus could still be used in a correlational analysis with productivity.

Eighty-five production workers were used in the determination of the scalability and unidimensionality of the morale instruments while twenty-nine teams were used in a comparison of average team morale with team productivity. In the sociometric analysis leading to an expression of work partner preference, twenty of the twenty-nine teams participated.

Conclusions

1. Neither striving nor liking morale in their various dimensions are here proven to be statistically significantly related to a measure of team productivity.

2. Team cohesiveness, as expressed by high work partner satisfaction, is not shown to be statistically significantly related to team productivity.

3. Cohesive work teams are characterized by significantly higher morale than less cohesive teams in the dimensions of morale having to do with friendliness of fellow workers and striving for company goals. Since only two of the eleven morale dimensions achieved statistical significance in this comparison, crossvalidation appears highly desirable.

Microfilm $2.00; Xerox $5.40. 106 pages.

A STUDY OF CHANGES IN CAPACITY AND DEVELOPMENT OF STUDENTS DURING A FOUR YEAR COLLEGE PROGRAM

(L. C. Card No. Mic 59-2341)

James A. Lyles, Ed.D.
Temple University, 1959

The purpose of this investigation is to determine the extent of changes of students in the spheres of mental capacity, educational achievement, and social attitudes which occur during participation in a four-year college program.

The need for this research is to be found in the tendencies of previous investigations to include only a single variable identifiable as a factor in the educative process, and a general scarcity of investigations of academic achievement at the college level reported in literature.

Owing to limitations of time and opportunity it was not possible to test, each year, the same group of students as they pursued their course of study in a liberal arts college. As an alternative procedure four groups of students, forty in each group, representing the four levels of college attendance, were selected. The groups were equated statistically in terms of intelligence quotient, reading grade, and English score, recorded at the time the students were admitted as freshmen.

Tests of general educational development, college level, as intelligence test and a social attitudes scale were administered to the groups during the 1957-58 school year. The educational achievement tests included the areas of English, social studies, natural science, and literature. The social attitude scale included the areas of society, education and work, and sex, marriage and the family. Appropriate statistical procedures were applied to the entrance and re-test batteries.

The intelligence test scores of each group were compared to the scores made by them at the time they entered college. The performance of each group on the academic battery and the social attitude scale was compared to that of every other group.

As a basis for interpretation a theoretical "expectation" was formulated. As the four groups were approximately equal in terms of mean scores on the entrance tests, it was assumed that the senior group would score higher than the juniors, sophomores and freshmen and in increasing measure depending on the period of college attendance.

On the basis of the findings it was concluded that most students' intelligence test scores change in a positive direction during college training and that this change occurs largely during the first year of study. The greater changes were made by those whose entrance intelligence test scores were below 110, but the change is not of sufficient magnitude to bring the scores up to the level considered essential for satisfactory participation in a college program, nor is there evidence indicating that this change in scores represents a change in mental capacity.

Academic achievement and social attitudes were found to be more directly related to the level of intelligence than to classification as senior, junior, sophomore or freshman, bringing into question the prevailing practice of granting diplomas and degrees on the basis of accumulation of hours and quality points, as well as the widespread belief that a student may be socially normal or accelerated while being academically retarded.

Microfilm $2.55; Xerox $9.00. 196 pages.

CERTAIN ASPECTS OF INDUSTRIAL AGING

(L. C. Card No. Mic 59-2562)

Howard Maher, Ph.D.
The Ohio State University, 1954

During World War II, American industry found itself dipping deep into its labor reserve. Much of this reserve was made up of older persons, almost two and a half million more workers of ages 45 and over being in the labor force in 1945 than under "normal" pre-war conditions. Estimates of future population demonstrate that much of industry's manpower will have to come from older ranks. It is estimated that by 1975 persons 45 years old and over will constitute nearly half of all persons over 20 years of age.[1]

The Present Problem. — Many studies bearing on the older worker are needed if industry is to utilize him effectively. The dissertation seeks to examine the assets and liabilities of the older worker and the criteria by which he is judged. It represents a somewhat novel approach, being confined entirely to the entire population of a single company. The orientation is in terms of criteria actually used by the company to evaluate its workers. Finally, the study has been designed so as to yield information on the concomitant characteristics of older ages which may have more relationship to job efficiency than age per se.

Description of the Company. — Company A is medium sized, having 5,000 personnel ranging from wage workers to research scientists. About 3500 of these employees are found in the wage classification. The supervisory levels number about 350 employees and the sales force, all college trained and selling technical products, consists of better than 500 employees. The studies here presented cover the above three groups, the entire personnel with the exception of 500 branch employees. The data may represent, therefore, one of the more extensive analyses of the age-efficiency relationship for any single industrial concern.

Age and Supervisory Personnel. — Three measurements were available for supervisory evaluation, namely, nomination data, forced-choice ratings, and graphic ratings. In the nomination procedure, executive personnel were requested to rank lower level supervisory personnel in order of value to the company. No consistent or significant relationship was found between the age of the nominator and the ranks assigned the nominees of various ages (Table I), the epsilon values shown, by chi-squared test, arising from a common population.

Table I

RELATIONSHIP OF AGE OF NOMINATOR TO NOMINATIONS ASSIGNED NOMINEES OF VARIOUS AGES

Ranker Age Group	Number of Rankings	Age of Ranked		r	e
		M	S.D.		
55-64	1380	43.7	10.30	-.08	-.17
45-54	1902	43.2	10.20	-.10	-.18
35-44	3557	41.6	10.10	-.14	-.21
25-34	702	41.2	10.05	-.08	-.17

Table II

SCORES OF YOUNGER AND OLDER WORKERS ON "FACTORS" OF A FORCED-CHOICE SCALE

	Planning	Attitude	Relations with Others	Routine Work	Initiative	Promotability	Experience
Favoring Young	+4	0	+3	+1	+13	+16	+2
Against Young	0	0	0	0	0	0	0
Favoring Old	+1	-1	0	-2	+2	0	+5
Against Old	-2	-2	-7	-1	0	-9	0
Net Young	+4	0	+3	+1	+13	+16	+2
Net Old	-1	-3	-7	-3	+2	-9	+5
Net Difference	5	3	10	4	11	25	3

A forced-choice rating scale, with a validity of .50 for average nomination standard scores, and an odd-even reliability of .93, was next analyzed in an attempt to discover item-age differences. Only 46 of 320 possible responses showed significant and valid difference between a 50 year and older group and a younger than 35 group. Where differences exist, however, they show interesting patterns (Table II). The first four rows of the table show the sum of the forced-choice key's weights for each of the logical categories into which items were grouped. The "favoring" and "against" weights were algebraically summed to obtain the "net young" and "net old" rows. The "net difference" is obtained by algebraic subtraction, yielding a single indicator of age differences. It may be seen that the older supervisor has advantage on "experience" items and positive value on "initiative." But he has considerable decrement on "potentiality" items, a condition as much a function of years remaining until retirement as of present job performance.

On the graphic scale, older supervisors show such positive characteristics as "cooperation" and "cost control." But, once again, the most serious decline with age is on a "potentiality" scale. From these results it is evident that older workers should be regarded in terms of their present performance rather than in terms of their "potentiality."

Age and Efficiency in the Sales Force. — Three measurements were available for salesmen. Nomination scores show a positive relationship with age. It is of interest that this nomination relationship with age tends to be negative for supervisory personnel.

These same positive relationships hold for the other two measurements, production records and graphic ratings. Only four of 21 product-moment correlations between age and production records failed to meet significance (.05 level). Older salesmen were found to require less supervision, to have lower percentages of salary to total sales, to have higher total sales, to have higher specialty as well as non-specialty sales, to have more sales coming through wholesalers in the territories, to make more calls on both retail outlets and on independent practitioners, to have higher sales objectives set by management, to realize more of the objective and more of the rated potential of their territories. Moreover, with the exception of wholesale sales and number of sales calls made, all of these measures are "valid" for nomination criterion group standing. Even more revealing, however, are the actual dollar sales medians for salesmen of various ages. Salesmen between the ages of 50 and 54 years were found to be selling $97,000 worth of products per year. Men in the thirty to thirty-four range were selling only 42 per cent of this figure, or $56,000. And men in the age group just prior to retirement were together producing $738,000 per year, a substantial amount to "lose" when these nine men retire.

On the graphic scale, older salesman are rated higher than younger salesmen on over-all sales, size of orders, sales to independent outlets, specialty sales, and individual sales drives. In terms of their sales presentations, they are better than younger salesmen where production is immediately forthcoming, i.e., in the retail outlet. They are also better than younger salesmen at display work, at stock inventory work, in appraising market needs, and, finally, in spending more time on the job. It would appear, therefore, that this is an area of work in which older men not only may hold their own but generally excell over younger ones.

Age and Efficiency among Rank and File Employees. — This study concerns the 1060 home office and plant workers of the total of 3500 hourly or wage workers in the company. The records used were of two kinds - worker characteristic data and criterion data, the latter being absenteeism, discipline, job mobility and pension records. The object of the study was to determine whether age had any relationship with the criteria, and more importantly perhaps, whether this relationship was in terms of age per se or whether any concomitants of age (education, job level, etc.) also influenced the relationship. The method used was that of factor analysis of the matrix made up of 12 worker characteristic and criterion variables. Two age variables, i.e., 35 years and over and 55 years and over, were "tacked on" to unrotated factors via the Dwyer Extension Method.

By use of a modified Thurstone Centroid Method, six factors were extracted (Table III) and rotated to both simple structure and meaningfulness. Factor I would appear to be an Economic Support factor, i.e., individuals described are married men with dependents, working in production rather than clerical jobs. They also have a tendency to have longer service and to be less educated. Of more importance for age analysis, however, is the fact that both age groups have significant loading on the factor. Thus older employees, as defined by either age

Table III

ROTATED FACTOR LOADINGS

	I	II	III	IV	V	VI	h^2
Age 35+	28	02	02	23	85	12	87
Age 55+	33	30	11	-02	77	-10	81
Sex	78	08	04	-26	-01	37	82
Marital Status	62	-08	-04	09	-06	31	50
Dependents	71	05	-02	00	08	47	73
Job Type	55	-59	03	42	34	09	98
Job Level	-05	85	06	-28	-40	-03	90
Education	-25	38	-03	-25	-53	-13	57
Length of Service	25	41	58	30	52	05	99
Discipline	10	-29	76	45	06	-35	96
Mobility	-05	45	50	05	23	15	53
Pension	06	24	-15	27	77	54	100
No. Absences	-08	-06	-06	70	-10	12	53
Days Lost	05	-01	-04	90	02	-05	82

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break, would appear to be more in a position of supporting others.

Factor II appears to be a White-Collar Work factor. The individuals are semi-skilled or skilled workers in clerical operations. They are inclined to be educated, long-service employees above fifty-five years of age. These individuals tend not to be disciplined and of such health status as to be "job-mobile." In summary, this is an area in which older workers may operate efficiently.

Factor III is a "triplet" involving mainly the criterion area. It most nearly appears as freedom from policy restriction, being composed of individuals who are not older personnel but who have sufficient length of service to be beyond the point at which disciplinary action has a serious effect upon a number of benefits. The factor loading for discipline is high, as is the factor loading for mobility.

Factor IV accounts for the major variance of the illness absenteeism frequency and severity measures employed in the study. Consequently, it has been named Illness Absenteeism. Absentees are mainly female, unskilled production workers. They are less educated and of longer service and also tended to join the pension plan. Above all, absentees are not the "very old" workers (fifty-five and over). Rather, they tend to be the "young-old," or the 35 and over group. Even this slight age relationship, however, may be more a function of other "cultural" conditions, such as type of job, amount of education, or job level, which have higher factor loadings.

In so far as Factor V has the highest loadings on age regardless of the reference point, it has simply been described as Age. The older worker is found to be a long service, less educated employee who works primarily on production jobs of an unskilled nature. His criterion characteristic is that, perhaps as a result of his needs and eligibility, he is a pension plan participant. The nature of these older worker characteristics may be more of a determinant of industrial behavior than are ages themselves.

The final factor would appear to describe Conforming Behavior; i.e., individuals are not disciplined and join the pension plan. Such an individual is a married man with dependents, this latter perhaps providing a reason for his conformity. The factor has no loading for either age group.

SUMMARY AND IMPLICATIONS

1. Older supervisors are rated lower than younger ones mainly on "potentiality," which if included in a total appraisal may obscure their present worth. Other areas would appear to yield only slight differences with age, or, as with "cost-control," "cooperation," and "experience," some advantage to the older. Furthermore, in these same supervisory groups, bias, as here defined, was not found to exist in the rating of one age group by another. A possible source of contamination is eliminated, at least for these data.

2. For 17 of 21 sales records, older salesmen are clearly superior to younger salesmen. This holds for rating data also. Especially noteworthy is a "loss" of $738,000 annually from the retirement of nine older salesmen.

3. Most older wage employees are relatively uneducated, unskilled, production workers with dependents; those on white-collar jobs are in a better position than the wage employees on discipline and mobility. Finally, the older employee is not among absentee groups.

4. All findings taken together imply the considerable value of the older person to industry. The implication for retention past the present retirement age is clearly established for salesmen on a dollar basis. There is also the implication that "socio-economic" handicaps and logically inappropriate criterion systems for supervisors and hourly employees need to be taken into account.

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1. Bureau of Labor Statistics. Employment and Economic Status of Older Men and Women. Washington, D.C.: Government Printing Office, (1952), pp. 13-18.

Microfilm $2.45; Xerox $8.60. 187 pages.

Abstract published by special arrangement with The Ohio State University.

THE SUPERIOR OLD PERSON: CASE STUDIES AND FURTHERING CONDITIONS

(L. C. Card No. Mic 59-2564)

John Patrick McNulty, Ph.D.
The Ohio State University, 1954

While the population of the United States doubled from 1900 to 1950, the number of persons 65 years of age and over quadrupled. The average life expectancy increased in this half century from approximately 49 years in 1900 to 68 years in 1950. With these changes came a great increase in the number of persons 60 years of age and older who were admitted to and were residents of state hospitals; about one-third of all first admissions were over 60, and about one-third of resident patients were aged. Relations of efficiency in work to age, retirment policies, housing for older people, means for their social life and recreation -- all such issues became increasingly important.

The Present Problem

Because the problems the aged present have been insistent, most research to date has dealt with the difficulties and inadequacies of the more maladjusted and handicapped of them. And the inference seems often to be that these conditions are general and inevitable in age and that old people necessarily present unusual problems. This is a decidedly questionable inference, and the dissertation, to test its validity, is a study of the exceptionally able and highly regarded older persons in their own communities to find out what their accomplishments in age might be and what personal characteristics and factors in their environments seemed to have made them outstanding. As detrimental circumstances have been demonstrated to be of import in the genesis of the maladjusted, so it should be possible to demonstrate that furthering circumstances contribute to the genesis of the superiorly adjusted.

"Golden Age Clubs" and other efforts to provide social contacts and recreation for old people have been much emphasized in recent years. Realistic yet sympathetic study needs to be made of the ways in which such efforts seem to be working out and of the values of these groups to the well-being of the aged. Fraternal and religious organizations have attempted to provide opportunities and

services to satisfy the needs of their older membership; assessment of these efforts as they affect mature personalities is needed. The study has aimed at some insights into the ways such programs are operating.

Where independent living is not possible for the old person, institutions and homes for the aged offer some security. These institutional environments differ, as do their effects on personality. The study of such contrasts might reveal both the conditions that make for continued personality integration in later years and the conditions that lead to disintegration.

To determine the strengths rather than the weaknesses of the older person, his merits as a worker need consideration. The investigation has therefore included study of certain data from a large industrial concern and a professional group to see whether values may not be found in older employees, and these perhaps developed and made more of.

People who are outstanding in old age might well have the ability to contribute to the study of aging as cooperators in the research rather than merely as investigated specimens. The study has attempted to see whether such cooperation was feasible and profitable. And largely in proportion as it was so, the study might also be somewhat of an action study, helping the groups and persons it investigates.

Methods and Materials

The superior older individual considered in the first part of the total investigation were selected by an informal nominating technique, by peers or by other persons in positions of leadership who knew them well. Interviews occurred in a variety of circumstances, including in the home, at business, or in a group meeting. A case might thus be seen as often as a dozen times, or even known for many years. These interviews were carried on in a permissive informal atmosphere and in a situation that was familiar and secure so that a case could feel free to talk about topics as he desired. Interviewers were mature people often already acquainted with a case or members of a group to which a case also belonged.

In the study of clubs and institutions for older people, the approach was similarly informal and of the "field study" type. Certain contacts were already available with some of these institutions and social groups, and other contacts were readily made. The writer or one or more of the other investigators visited the group under consideration. These visits were quite informal. For example, the writer attended the meetings of a "Grandmothers Club" for some five months and was made an "honorary member." He helped, among other things, to set up tables and arrange for meeting places. In a Golden Age Club he played euchre and canasta with some of the members and otherwise merged himself with the group, got acquainted, and tried to see how things went on. Homes for old people were similarly visited in a very friendly informal fashion.

The first of two investigations regarding relations of age to occupation dealt with appraisals (including education, score on a short practical arithmetic test, absence and lateness records, supervisors' ratings, peer ratings, and a total rating including yet other material) of some 1400 male workers being considered for supervisory positions in a large industrial concern with a total payroll of some 18,000. In contrast, the second age-occupation study was intensive: 48 women teachers 30 years of age and under were compared on the Thurstone Temperament Scale with 48 who were 55 and over in age.

Results

In appraising the case reports of the intensively studied old people the first effort was to bring all the material together regarding each individual and to try to see him as a total personality. The following two paragraphs give, in miniature, pictures of two of these cases.

At the time of the interview Mrs. A. was 101 years old. Though somewhat deaf and of dim vision, she greeted her guests (an old friend of hers, the interviewer, and the interviewer's wife) with fine courtesy. Talk was vivacious. Recollection of events from before the Civil War to the happenings of that morning seemed accurate. Topics of conversation were held to. Comments were keen. In short, though she was suffering from sensory handicaps and the stiffness of age, her intellect and personality seemed intact. The housekeeper and long-time acquaintances verified this conclusion. Mrs. A. continued to have many friends and had been active in community and church until very recently. She had been born across the street from where she now lived, had spent almost her whole life in this small college town, had been happily married to a leading citizen of it, had two fine children, had been a leader in church and community. She came from a healthy long-lived family. Constitution, upbringing, activities, integration with community—all might be thought of as combining to maintain her into her extraordinary old age.

In contrast was Mr. C., a commercial artist retired by his firm arbitrarily at 65; at about this same time the church in which he had been active for 40 years seemed about to collapse; shortly before, the idolized only daughter had married and moved to a distant city. Thus three main elements in his life seemed to be disappearing simultaneously. Routine habits of life seemed largely to break up; there were no strong interests. Friends urged him to develop his artistic skill into a hobby, but everything of that sort was so close to the former work he regretted abandoning that it distressed him. With the general disintegration of his existence came a cardiac episode, and deterioration seems to be preceding rather rapidly.

The contrasting case summaries give some hint of the flavor of two very different lives, the first moving forward in a consistant pattern and the last disrupted and broken. For more systematic analysis, 12 cases which careful appraisal indicated to be well adjusted were contrasted with 12 cases which careful appraisal indicated to be poorly adjusted. The following brief table summarizes case findings regarding the five most differentiating characteristics, each person having been rated as superior, average, or poor in that trait. The most differentiating characteristic was the extent to which the case was recognized as a fine person by associates; the outcome might be expected because of methods of selection, but recognition was probably also a stimulating factor. The most differentiating characteristic was the cheerfulness of the superior group. The superior group also was differentiated from the inferior by their tendency to look toward the future, not simply back, and to have evident vitality and many friends.

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Table I

Traits Showing Most Differences Between 12 Superior and 12 Inadequate Old People

Characteristic	Classification High 3	Avg. 2	Poor 1	Weighted Totals	Difference
Recognition					
Superior	9	3		33	
Inadequate	1	5	6	19	14
Mood					
Superior	8	4		32	
Inadequate	1	5	6	19	13
Future Plans					
Superior	8	4		32	
Inadequate	3	1	8	19	13
Vitality					
Superior	11	1		35	
Inadequate	4	3	5	23	12
Friends					
Superior	9	2	1	32	
Inadequate	3	2	7	20	12

The table shows that 9 of the superior were very highly regarded by those who knew them and 3 were well regarded, but none were generally considered unfavorably. Counting "high" as 3, average 2, and poor 1, the weighted total for the superior becomes 33 (9 times 3 plus 3 times 2).

Table I gives part of only one method of comparing these two extreme groups. Reports of 119 superior cases were screened to yield 66 individuals who were known by at least two interviewers over some period of time, and were not in any type of institution. Careful study of this larger group suggested, first of all, that there were two important (though not necessarily essential) prerequisites to a "successful" old age: a reasonable good health and some economic security. Occupations which could be somewhat continued into old age were especially well represented. Thus a physician over 90 continued to see some patients; a tailor in his eighties continued some work. The great majority had "service" activities contributing in some fashion to others; they were well known and favorably regarded in their communities, cheerful, looked ahead, were active beyond what might be expected of their years. On the whole, their maintenance of interests and activities of some worth, and of a circle of friends, and their outgoing, forward-looking attitudes were judged to be the most significant characteristics.

The observations of groups serving old people were of a very informal and almost participant nature --as already mentioned. Their nature can best be indicated by greatly abbreviated sample descriptions of two meetings, first of an unsatisfactory group for older persons and then of an excellent group for them.

A group consisting of some twenty women on old age assistance in a slum district gathered in an old settlement house room shortly before the noon lunch hour. The president (generally disliked but occupying that position since the club had been founded seven years ago because she then took charge) made conversation by asking if any had had rents raised, when old age assistance checks were due, and so on. The plain but hearty meal was eaten with little talk; the group then sat about apathetically. The president suggested some songs. Song books supposedly available could not be found --the room is used for many other purposes. Finally the president sat down to the piano and "led" singing, but there was practically no participation. Then she raised certain questions about the next meeting, but there was almost no discussion and she made the decisions herself. Next she showed some material which she suggested might be made into carrying bags for groceries and other items, but there was little interest. After a little further perfunctory talk the group broke up.

It might be said that most of the members of the above group had little to contribute. It is held together primarily by the woman in charge, herself old, who takes charge of all the arrangements for the noon meals, visits the members in their homes, and shows a sincere though largely charity-giving interest in them. Essentially there is no participation on the part of the members, no program other than the meal, and no major purpose.

In contrast, a sample meeting of another club for women went as follows: About an hour before the gathering time, a previously designated committee of five arrived to clean the dishes and arrange the refreshments. The main group arrived rather promptly at the meeting time. A lively business meeting, with much participation from the floor, began the proceedings. New members and visitors were introduced, and quite a bit was made of them --thus at refreshment time new members sat at the table with the officers. After the business meeting the drill team put on an exhibition; a large proportion of the members belonged to the team. Lively singing was led by a member who had been a music teacher. Almost everyone joined in vigorously. Next the group marched by the collection boxes where the small dues were put and where there was also opportunity to contribute to a hospital. Then refreshments were announced and the group filed by the serving table, each receiving a generous allowance of ice cream, cake, and coffee. Conversation was general and merged into a brief social hour, after which the group broke up.

The leadership was largely within the group, the general participation, the variety of activities, some of them literally very active for such old people, and the purposes and services extending beyond themselves (as helping the hospital) all seemed characteristics differentiating this group from the previous one.

A third group of old people was yet different. It consisted mostly of sub-groups, each interested in a different game - canasta, euchre, bingo. It also had refreshments and a monthly dinner. Business meetings were perfunctory and even a bit disorderly. There was a lack of welcome for new members; two who were new that day were nodded to when introduced but then wandered from one game table to another, found no place, and then sat down together by the water cooler.

Several groups serving old people in part were also observed. A church group made up primarily of older women had a repetitious pattern of meetings for the most part in the church parlors, but occasional meetings in homes and programs of some variety aroused more interest. Two fraternal orders which make much of their homes for older members seemed characteristically to neglect the older people still in their communities --unless they became ill or died.

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In short, it appeared that groups for old people varied greatly in vitality and leadership, and probably needed distinctive planning regarding procedures and activities like those that have gradually emerged from work with children and adolescents. But even the less satisfactory groups seemed of great value to old people often very much alone in the world and clutching for anything which gave them some companionship and sense of belonging. In view of such needs the failure of fraternal groups to develop positive programs for the old members in their midst seems almost disgraceful. And the emphasis in churches on the young seems often to leave the old neglected.

Institutions for old people were also found to differ greatly. The least satisfactory one psychologically had the most attractive building, on spacious grounds. But the "guests" tended to be crotchety and complaining and kept each to her own room. In contrast, the old women in a home less pretentious were frequently together in friendly fashion and seemed happy. The location near the center of a small city was unattractive but actually had many advantages; the residents able to do so enjoyed walking about the business district and window-shopping, stopping for coffee, and going to a local movie house which admitted them free. Townspeople, members of local churches, and students from a nearby college often dropped in. The stir of life close by along the street seemed stimulating rather than disturbing. And the friendly tolerant matron accepted all this coming and going as essentially healthy. The first institution was too remote in its spacious grounds on the far outskirts of a city, the matron over-protective, and the 15 retired teachers who lived there a group so small and so homogeneous that they got on each others nerves. The second and happier institution was twice as large, and the women there had a variety of backgrounds. Visits to other institutions emphasized the conclusion that such places should be removed as little as possible from the stream of life, and not too small or homogeneous, and should foster activities and interests rather than be protective.

Table II

Some Appraisals of Workers Considered for Promotion in a Large Factory

	Age				
	20-29	30-39	40-49	50-59	60 up
Percent late or absent	41	33	19	12	6
Median peer rating*	182	184	175	173	163
Median supervisors' rating*	193	192	184	176	139
Number of cases	369	390	456	137	35

*The great range of these ratings is indicated by the fact that the 10 and 90 percentiles for peer ratings of twenty-year-olds were 113 and 213 and median of those 60 and up was at the 36 percentile for those in the twenties.

Data from the large manufacturing company, as would be expected, showed that the older workers had had somewhat less education and had scored lower on an arithmetic test. But they were least often absent or late. Their peers rated 28 per cent of those 60 and over above the median for the 20 year olds; the supervisors so rated 22 per cent of this oldest group, of which 31 per cent so scored on the total ratings. And it is a fair guess that stereotypes against age probably tended somewhat unfairly to depress some appraisals of the older workers.

The Thurstone Temperament Scale showed the 48 teachers aged 30 or younger to be more active, vigorous, impulsive, dominant, and social than the 48 who were 55 or older; but these last were more "reflective" (the adjectives refer to sections of the scale). Significant at the .01 level were item differences such as these: the younger more often participated in sports, liked excitement, spent evenings with friends. But the older were more often cool and composed in a dangerous situation, could put strangers at ease.

Summary

The teacher and industrial studies last mentioned indicate that there are indeed age differences in traits, with the older showing certain important merits. Yet the ablest old were probably not included, having gone on to more skilled or more administrative positions. The studies of the homes and clubs for the aged, and the other groups serving them in part, showed some of these groups to be very inadequate; but it was clear that they could render great service to older people, and did so to the extent that they kept the old in touch with life, activily participating in social affairs and outgoing in purpose. The superior old were found to be splendid people, the best of them having a distinctive mellowed wisdom and a mature personality, for which there is great need. Greater knowledge of the old should bring about more such old people, and utilize them more fully.

Microfilm $3.05; Xerox $10.40. 234 pages.

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VERBAL MEDIATION OF APPROACH AND AVOIDANCE RESPONSES

(L. C. Card No. Mic 59-2667)

Samuel Herman Osipow, Ph.D.
Syracuse University, 1959

The purpose of the study was to investigate the acquisition of labels and their role in mediating attitude change. It was proposed that names attached to neutral objects would mediate changes in preference for those objects corresponding to the affective associative components of the name.

The rationale was based on Dollard and Miller's hypothesis that labels may be cue-producing responses. The mediational process was assumed to occur by a process similar to Hull's rg-sg mechanism.

Three general hypotheses were investigated:

1. The rate of acquisition of labels for unlabeled objects is not a function of the meaning of the labels.
2. The rate of acquisition of labels for labeled objects

is an inverse function of the disparity between the meanings of the old and new labels.

3. A change in attitude is mediated by the preference associations stimulated by labels.

The experimental design followed that of Bugelski and Scharlock. The first learning task required the connection of a label (R_1) to a neutral object (S_1). The second task required that the label R_1 serve as S_2, and stimulate an evaluative response, R_2. The third task presented the original stimulus, S_1. It was expected that R_2 would occur, thus directing behavior toward the object.

Ss were 56 fourth grade children.

A series of pretests were administered to the Ss as follows: a test (a) to determine Ss knowledge of the meanings of the evaluative words "pretty" and "ugly" (b) to determine the preference value of the words "pretty" and "ugly" (c) to determine preferences for a series of 8 colored objects, and (d) to determine initial preferences for 8 nonsense figures.

One control and three experimental groups were administered treatment in each phase as follows. In Phase B, Groups I and III labeled neutral figures by most and least preferred color names. Groups II and IV labeled neutral figures by neutral color names. In Phase C, Group I labeled its most preferred color "pretty" and its least preferred color "ugly;" Group II labeled neutral color names "pretty" and "ugly;" Group III labeled its most preferred color "ugly" and its least preferred color "pretty;" Group IV, the control, labeled neutral colors "X" and "Y."

The findings were as follows:

Hypothesis 1 was supported. No differences existed between the groups in Phase B in the rate of acquisition of labels for previously unlabeled objects.

Hypothesis 2 was supported in part. Group I had the most correct responses over trials, as expected. Groups II and III did not differ in the number of correct responses over trials. It was expected that Group II would have more correct responses than Group III.

Hypothesis 3 was supported in part. Groups I, II, and III showed an increase in preference for the figure paired with the color called "pretty" and a decrease in preference for the figure paired with the color called "ugly." However, Group IV also showed preference changes, i.e., an increase in preference for the figure paired with the color called "X" and a decrease in preference for the figure paired with the color called "Y."

The implications of the study were two in number. The first was that labeling apparently mediates a change in attitude, but the exact nature of the process was not defined by this study. The second implication is methodological in nature. The use of the "X"-"Y" control in studies of mediation assumes importance. The control in the present study prevented unwarranted conclusions.

Several changes in experimental procedure were suggested that might result in a clearer demonstration of the mediational process.

Microfilm $2.00; Xerox $5.00. 97 pages.

INDIVIDUAL EMPATHY IN RELATION TO CERTAIN ASPECTS OF GROUP FUNCTIONING

(L. C. Card No. Mic 59-2656)

Joseph McElroy Rich, Ed.D.
Temple University, 1959

This investigation was designed to explore the effect of the empathic abilities of individual group members upon group functioning. It was predicted that groups composed of persons of high empathic skills (hi-emps) would function somewhat differently from groups composed of persons of lesser empathic skills (low-emps). The research was limited to five aspects of group behavior:

1. The proportion of emotionally malintegrative behavior, using the interaction categories of Bales.
2. The proportion of total emotionality, using Bales' categories.
3. Interest in the contributions of other group members, using Bales' categories and Findley's Balance of Participation Index.
4. Participation in group activities, defined as contributions per minute.
5. Gains in cohesiveness within the group, using the Kight-Reppert Work Companionship test on two occasions separated by seven weeks of group meetings.

Each aspect was tested by comparing hi-emp groups with low-emp groups, and by comparing hi-emp individuals with low-emp individuals regardless of group assignment.

The relationship of the two instruments used for measuring empathy was also examined.

Subjects were 143 students in six classes of the Evening Teachers College course in Group Development. They were subdivided into 20 groups of six to eight members which met regularly during the course. Students were assigned to groups on the basis of their scores on the Kerr-Speroff Empathy Test, as well as their sociometric compatibility and their choice of topics for group discussion. There were one hi-emp group, one low-emp group and one or more mixed groups from each class.

Ten minute samples of interaction were taken in all groups during every session in which they met, using Bales' techniques. Dymond cross-questionnaires of empathy were secured from each subject near the end of the semester. All data were analyzed by the t test of Fisher.

Findings

1. Groups and individuals of high empathic skill (Dymond test), tended to express less emotionally malintegrative behavior than did those of less empathic skill ($p = .001$ to $.02$).
2. Groups of high empathic skill (Kerr-Speroff test) showed a slight tendency to express less emotionally malintegrative behavior than did those of less empathic skill ($p = .10$). The same did not hold for individual data ($p = .20$).
3. No significant differences were found between hi-emp and low-emp groups or individuals in relative

proportion of overall emotionality expressed or in relative interest in the contributions of other members of the group.

4. Individuals of high empathic skill (Dymond test) showed a slight tendency to be more active participants in group discussion than did those of less empathic skill (p = .10). The same did not hold for group data (p = .40), nor for the Kerr-Speroff criterion.
5. Individuals of high empathic skill (Kerr-Speroff test) showed a slight tendency toward a greater increase in group cohesiveness than did those of less empathic skill (p = .10). The same did not hold for group data (p = .40), nor for the Dymond criterion (p = .40).
6. The Dymond and Kerr-Speroff methods appear not to be measuring the same attributes of personality (p = .20 and larger).

Conclusions

Further study of empathy and group functioning might include:

1. Some different method of measuring empathic skills, perhaps modeled after Dymond, but less ego-involved.
2. Methods for more qualitative examination of the kinds of interaction which occur.
3. A measure of group productivity.
4. A measure of the social atmosphere which develops in each group.

With the development of such tools, further study holds considerable promise toward understandings of group structuring, leadership and participation, and eventually for the selection among candidates for positions involving work with groups.

Microfilm $2.00; Xerox $6.20. 126 pages.

ORIGINALITY AND PERSONALITY: AN EXPLORATORY INVESTIGATION TO STUDY THE RELATIONSHIP OF ORIGINALITY TO CERTAIN PERSONALITY VARIABLES IN ART STUDENTS

(L. C. Card No. Mic 59-1035)

Eric Riss, Ph.D.
New York University, 1958

Chairman: Associate Professor John H. Sullivan

This was an exploratory study of the relationship of personality to originality. The study dealt with two main problems. First, it dealt with an investigation of personality differences between college art students (the experimental group) and college non-art students (the norm group). The personality variables investigated were those measured by the Guilford-Martin Inventory of Factors GAMIN: general pressure for vigorous overt activity, ascendancy and social leadership, masculinity-femininity, self-confidence, and nervous tenseness and irritability.

The second problem concerned the relationship of these personality variables to tendencies in art students to select Rorschach responses of varying quality and originality when presented with a series of Rorschach responses and required to rank them according to the degree to which they seemed to "fit" the Rorschach ink blot. These responses consisted of original and reality bound (O-), original and not reality bound (O-), and popular or commonly given (P) Rorschach responses. These responses were presented by means of a modified multiple choice version of the group Rorschach technique (the MMCR) developed especially for this study. Each experimental S was classified into one of three categories as determined by the type of response that predominated in his selections: O+, O- or P. Hypotheses relating personality variables to selection tendencies for the three types of Rorschach responses were formulated and then tested using a 3 x 5 x 2 analysis of variance. Hypotheses relating personality variables to selection tendencies for Rorschach responses according to an O (undifferentiated for "quality" i.e. neither + nor -) and P category were then formulated and tested by means of a 2 x 5 x 2 analysis of variance. Additional hypotheses dealing with sex differences in the experimental and norm groups were also formulated and tested.

The Ss constituting the sample for this study were volunteer New York University and Brooklyn College undergraduate and graduate students whose average age was 25 years and whose age range was from 18 to 36. The norm group consisted of 529 Ss of whom 269 were males and 260 were females. The experimental group consisted of 78 Ss of whom 37 were males and 41 were females.

Under the conditions of this experiment and within the capabilities of the measuring devices used, the primary general results were that art students and non-art students differed on certain personality variables and that within the art student group, personality differences existed among the O+, O- and P groups. Specifically the results were:

1. Male art students showed less pressure for vigorous overt activity, less ascendancy in social situations and less leadership ability than male non-art students; female art students evidenced greater masculinity of attitudes and interests than female non-art students.
2. Male art students and male non-art students showed no significant differences on the following personality variables: nervous tenseness and irritability, self-confidence, and masculinity-femininity; female art students and female non-art students showed no significant differences on the following personality variables: general pressure for vigorous overt activity, ascendancy in social situations and leadership ability, self-confidence, and nervous tenseness and irritability.
3. Non-art students showed a higher incidence of significant sex differences on the GAMIN than art students.
4. Art students who selected O+ Rorschach responses predominantly showed greater ascendancy in social situations and greater leadership ability than art students who selected O- or P responses predominantly. Art students who mainly selected O- Rorschach responses did not differ in ascendancy in social situations and leadership ability from art students who selected P responses predominantly.
5. Art students who selected O- responses predominantly

showed less nervous tenseness and irritability than art students who selected O+ Rorschach responses predominantly.

6. No significant differences were noted among art students who mainly selected O+, O- or P Rorschach responses on the following personality variables: general pressure for vigorous overt activity, masculinity-femininity, and self-confidence.

7. Although personality differences among art Ss could not be elicited when considering only those Ss who select O or P responses, it was possible to elicit personality differences when differentiating for quality of originality, i.e., considering O+, O- and P responses.

The results were discussed in terms of the implications they have for the following areas: the psychology of the artist, originality and personality theory, psychotherapy, and general education and art education. In addition, suggestions for future research were outlined and a theoretical statement, couched in operational terms, relating personality to original behavior was formulated.

Microfilm $2.00; Xerox $6.20. 129 pages.

IMPROVEMENT RATE IN TUBERCULOSIS AS A FUNCTION OF ACCESSIBILITY TO REPRESSED EMOTIONAL DISTURBANCE

(L. C. Card No. Mic 59-2614)

Harry J. Rosenthal, Ph.D.
University of Southern California, 1959

Chairman: Professor Georgene H. Seward

Psychological factors are considered contributory to the onset and important in the course of tuberculosis, but research dealing with effect of emotional factors on improvement rate is meager.

According to the psychoanalytic frame of reference, psychotherapy may alleviate or help to dissipate physical symptoms to the extent that the latter are connected with emotional factors and are reversible. Also, it is assumed that the prognosis is better the more the patient can free-associate to repressed areas of emotional disturbance and the fewer his areas of conflict.

On the basis of the above assumptions, it was the purpose of the present study to test the hypothesis that accessibility to repressed emotional disturbance as measured by (1) ability to free-associate to such areas of disturbance and (2) lesser number of repressed conflict areas is directly related to improvement rate in tuberculosis.

A greater pathology group of 33 pulmonary tuberculosis male patients and a lesser pathology group of 31 male patients ranging in age from 20 to 40 years were selected. All were semiambulatory and had attained bacteriologic conversion. They were matched in all factors considered relevant to the dependent variable.

The basic psychological instrument was the Jung Word Association Test, which was administered in the usual fashion. In addition, the subject rated all the stimulus words with respect to affective impact on him, on a scale ranging from "no" discomfort to "great" discomfort. Five emotionally loaded words were then selected for each subject according to the double criterion of (1) "no discomfort" rating, (2) two complex indicators. An equal number of neutral words was also selected. Following this procedure, the subject free-associated to each of the ten words for a period of a minute.

The dependent variable was improvement rate measured in terms of days elapsed from initiation of continuous hospitalization until the attainment of semiambulatory status. The independent variable was accessibility as measured by a ratio of the subject's associations to loaded words to those to neutral words and by the total number of stimulus words rated not disturbing by the subject, but which nonetheless bore complex indicators.

From these conditions it was predicted that, provided nonemotional factors were controlled, (1) the ratio scores of accessibility would vary directly with improvement rate and (2) the number of loaded words rated not disturbing would vary inversely with improvement rate.

In the greater pathology group, the results tended to confirm the hypotheses that each measure of accessibility to repressed emotional disturbance is related to improvement rate. The hypotheses were not confirmed in the group having minimal pathology. These results suggested that amount of energy used in repression plays a relatively unimportant part in minimal somatic involvement. The findings also suggested that number of conflict areas rated disturbing as well as number of these areas irrespective of disturbance rating was not related to improvement rate.

Future research involving replication of this study and investigation of its use as an aid in prognosis and assessment of progress in psychotherapy was discussed.

Microfilm $2.00; Xerox $4.60. 90 pages.

THE RELATIONSHIP BETWEEN EXTENT OF AFTEREFFECT AND SPEED OF A ROTATED SPIRAL

(L. C. Card No. Mic 59-2432)

Judith Gruender Singer, Ph.D.
Boston University Graduate School, 1959

Major Professor: Austin W. Berkeley

The purpose of the present study was twofold. First, a new technique for assessing the extent of the spiral aftereffect was utilized; and second, one parameter of the spiral, speed of rotation, was systematically examined.

The recent literature on the spiral has consisted of establishing the diagnostic ability of the instrument for organic subjects. Examination of the parameters of the instrument itself has been limited by the lack of an adequate technique for assessing the extent of the aftereffect.

None of the extant theories were capable of predicting either the direction, of expansion or contraction, or the function of speed on the aftereffect. A post hoc explanation was offered to explain the effect of speed on spiral aftermovement by an extension of the statistical summation theory. The following prediction was based on pilot data with the intent to determine if speed was a stable general function of the aftereffect:

As spiral rotation speed increases from zero to fusion, the aftereffect will first increase and then decrease.

A population of responses was sampled from four male employees of a Veterans Administration Hospital. Twelve speeds of a hyperbolic spiral were selected: 0, 3, 12, 21, 37, 61, 76, 94, 134, 200, 260 and 500 rpm. Each speed was presented three consecutive times in random sequence each day for fifteen days. The two measures were duration and displacement. The inspection period was 30 seconds. The experimental hypothesis tested was:

General Hypothesis:
The speed of rotation of a spiral will determine the extent of the aftereffect when other variables are controlled.

Specific Hypothesis:
As speed of rotation of a spiral is increased from zero to fusion, the aftereffect will increase and then decrease.

A three classification analysis of variance was applied to the data. The specific hypothesis could be supported for all four subjects. The data supports the assumption that the curvilinear relationship is a stable general function. Unexpected findings were that there was a significant effect over days, and a significant effect of days x speeds interaction. Further analysis of days revealed no general trend for all subjects. Further analysis of S x D by analysis of runs revealed that few days actually departed from pattern. The S x D interaction was interpreted to mean that idiosyncratic changes occurred for all subjects across days and speeds. It was pointed out that speed absorbed such a large part of the variance that the resulting error term was small and therefore this interaction, which might otherwise have been random, was statistically significant.

Displacement was found to be the most stable measure of the aftereffect. Correlation of the two measures showed them to be highly correlated. An examination of modal speeds revealed for all subjects there is no stable optimum speed for the aftereffect, but in general it is between 37 and 76 rpm. Individual differences were manifested by the overall magnitude of the aftereffect.

Implications of the experiment were discussed. In general, the results were consistent with the main body of figural aftereffect literature. The differences between the Archimedes and hyperbolic spiral were discussed as they applied to the phenomenal experience. Finally, suggestions were made concerning further research which might be carried out which would be important for development of future theories to account for the spiral. Predictions for organics were discussed.

The conclusions which may be drawn are:

1. Under the conditions of this experiment, the spiral aftereffect rapidly increases, then gradually decreases as a function of ascending speeds.

2. Although speed is a stable general function, there are individual differences in magnitude of effect.

Microfilm $2.00; Xerox $6.60. 140 pages.

THE ASSESSMENT OF EMPLOYEE MORALE: A COMPARISON OF TWO MEASURES

(L. C. Card No. Mic 59-2757)

Ronald Paul Yuzuk, Ph.D.
The Ohio State University, 1959

This investigation compares the traditional employee morale survey, which seeks an evaluation by the respondent concerning "agreement" or "satisfaction" with certain general facets of the work environment, with a newer approach which involves a description, in terms of the number of objective events that occur, of the work environment.

The study utilized 382 employees, of all skill levels, who represented 19 departments of an electric coil manufacturing firm.

Preliminary inventories (126 items) representing both approaches, constructed from information culled from interviews, were administered to comparable samples of 65 employees.

Both final forms, which contained 85 items selected from the preliminary scales on the basis of their correlation with eight criteria, were administered to comparable samples of 126 workers.

A Wherry-Winer item factorization yielded the following Evaluative scale factors: a General factor, Technical Competence (supervisor), Overall Attitude toward Fellow Employees, Pride and Confidence, Job Satisfaction, Adequacy of Communications, Fairness, Conditions of Work, Interpersonal Relations (supervisor), and Financial Rewards. Descriptive form factors included Adequacy of Communications, Hours of Work, Technical Competence (fellow employees), Interpersonal Relations (fellow employees), Status and Recognition, Conditions of Work, Interpersonal Relations (supervisor), Technical Competence (supervisor), and Job Satisfaction.

A comparison of the two instruments concerning biasability revealed that only the Evaluative scale possesses a large, diffuse, general or bias factor. This difference is interpreted as a function of the basic difference between the inventories, that is, the nature of the item--the relatively general and ambiguous Evaluative item as opposed to a more objective, specific approach accounting for the bias.

The estimation of reliability, as accomplished by a modification of the Kuder-Richardson Formula Three, indicates that the Evaluative (.81) possesses a greater degree of average reliability than the Descriptive scale (.61). However, the formula utilized, which is primarily based on the correlation between items within a given subtest, may exaggerate this disparity in reliability, since the bias factor influence greatly fortifies the Evaluative form within subtest homogeneity. The prophesied reliability of the average subtest of either form, if it contained as many items as the average morale inventory, is in the nineties.

As a foundation for the comparison of relative "validity," the departmental morale factor indices were correlated with eight departmental "performance" averages and with the scores yielded by a Thurstone Centroid factor analysis of these criteria. These intercorrelations indicated that the Evaluative general factor does not significantly relate to any of the correlates. Thus it is feasible to conclude that if the ubiguitous influence of this

general factor had not been suppressed, the Evaluative inventory would have demonstrated no relationship between morale and performance. However, with all factors purified by a suppression of extraneous factor loading, both scales were comparable in the number of significant (.05 level and beyond) correlations with the criteria: Supervisor ratings correlated negatively with Job Satisfaction. Labor grade (skill level) related positively to Adequacy of Communications, Status and Recognition, and Job Satisfaction; and negatively to Working Conditions, Financial Rewards, and Technical Competence of Fellow Employees. Visits to the medical unit related negatively to Working Conditions and Technical Competence of the Supervisor. Tenure correlated positively with Overall Attitude toward Fellow Employees and negatively with Hours of Work. Absenteeism related positively to Technical Competence of Fellow Workers and Working Conditions and negatively to Job Satisfaction and Interpersonal Relations of the Supervisor. Tardiness correlated negatively with Interpersonal Relations of the Supervisor. Turnover related negatively to Technical Competence of the Supervisor. Production correlated negatively with Working Conditions. Thus certain dimensions of employee morale, if cast in a relatively bias-free form, do tend to relate to selected facets of employee performance.

Microfilm $2.00; Xerox $4.80. 92 pages.

PSYCHOLOGY, CLINICAL

DISTORTION OF THE SELF AND OTHERS IN SCHIZOPHRENIA

(L. C. Card No. Mic 59-2570)

Victor Anthony Aspromonte, Ph.D.
Columbia University, 1959

The present study investigated the relationships between severity of illness in schizophrenia and the amount and direction of self distortion and distortion of others. Theoretical and experimental literature was reviewed and hypotheses were formulated to determine whether the more severe the illness, in schizophrenia, (a) the greater the amount of self distortion, (b) the more favorable the self distortion, (c) the greater the amount of distortion of others, (d) the more unfavorable the distortion of others.

A group of 58 male schizophrenic subjects, patients at the Veterans Administration Hospital, Montrose, New York, were used in the study. The Ss rated themselves and six peers on ten bipolar personality traits, each trait being rated on a six-step graphic scale. The Trait Scales were bipolar in respect to positive and negative aspects of the trait. A second self rating as well as a second rating of the best known peer was secured from each S. All Ss and peers were rated by no less than ten members of the nursing staff on the ten Trait Scales. Two Montrose Adjustment Scale ratings, indicating severity of illness, were secured for each S from the ward Psychologists. Absolute self distortion was defined as the absolute mean difference between Ss' self ratings and the criterion group's ratings of Ss on the ten Trait Scales. Algebraic self distortion was defined as the algebraic mean difference between Ss' self ratings and the criterion group's ratings of Ss on the ten Trait Scales when signed values of (+) or (-) were given to differences in the favorable or unfavorable direction respectively. Absolute distortion of others was defined as the absolute mean difference between Ss' ratings of the six peers and the criterion group's ratings of the peers on the ten Trait Scales. Algebraic distortion of others was defined as the algebraic mean difference between Ss' ratings of the six peers and the criterion group's ratings of the peers on the ten Trait Scales when signed values of (+) or (-) were given to differences in the favorable or unfavorable direction respectively.

Pearson product-moment correlations were computed between the Montrose Adjustment Scale scores and the four distortion scores, absolute self distortion, algebraic self distortion, absolute distortion of others, algebraic distortion of others.

The following hypotheses were confirmed:

1. The degree of illness in schizophrenia is positively related to the amount of self distortion.
2. The degree of illness in schizophrenia is positively related to the amount of distortion of others.

The following hypotheses were not confirmed:

1. The degree of illness in schizophrenia is positively related to the direction of self distortion, that is, the more severe the illness, the more favorable is the self distortion.
2. The degree of illness in schizophrenia is negatively related to the direction of distortion of others, that is, the more severe the illness, the more unfavorable is the distortion of others.

Since the rating scales were found to be sufficiently reliable for group analysis, doubt was cast on the applicability of the Sullivanian formulation regarding grandiosity of self and disparagement of others to schizophrenics in general. Limitations of the study were discussed and suggestions for further research advanced. A particularly meaningful lead for further study was secured from adjunct data regarding inconsistency of performance in schizophrenia and its relation to the main variables studied.

Microfilm $2.00; Xerox $4.00. 75 pages.

DIMENSIONS OF WORK SATISFACTION IN THE OCCUPATIONAL CHOICES OF COLLEGE FRESHMEN

(L. C. Card No. Mic 59-2523)

Alexander William Astin, Ph.D.
University of Maryland, 1958

Supervisor: Professor John W. Gustad

This study was concerned with investigating the motivational variables underlying various aspects of work satisfaction and also with relating these variables to the vocational choices of male college freshmen.

Two hypotheses were proposed for study:

1. The relationships among various aspects of work satisfaction are describable in terms of a limited number of motivational variables.

2. These motivational variables are significantly related to the vocational choices of college freshmen.

An initial set of 22 items was selected to cover three general areas of rewards from work: intrinsic satisfactions, monetary-prestige rewards, and concomitant satisfactions. Four experienced psychologists were asked to evaluate these items in terms of clarity, comprehensiveness, and independence.

A final set of 21 items was administered to 355 male college freshmen who were asked to respond to each item on a seven-point Desirability Scale. A representative sample of 200 subjects was randomly selected from the original 355 freshmen. The item scale scores for these 200 subjects were intercorrelated, yielding a matrix of 210 correlations.

A cluster analysis of the matrix produced four clusters. Inspection of the item content for each cluster resulted in the following trait descriptions for the first three clusters:

I - Managerial-aggressive. A need to dominate in interpersonal relationships and to control the behavior of others in the working situation.

II - Status-need. A concern with the monetary and social prestige outcomes of work.

III - Organization-need. A desire to structure and organize both the work and the job environment.

The items in the fourth cluster did not suggest a meaningful interpretation so that it was not included in the validity analysis.

From the original sample of 355 students, 196 were distributed into the following nine categories of vocational choice: accounting, engineering, farming, managerial, medicine-dentistry, persuasive, sales, teaching, and undecided. These sub-samples served as criterion groups with which to evaluate the first three traits. Trait scores were obtained by summing the scale scores for those items with the highest correlations within the cluster.

Analysis of variance of the means of the nine criterion groups on Trait I (Managerial-aggressive) produced a significant F-ratio ($p < .01$). Students selecting careers in sales, managerial, and persuasive occupations obtained the highest scores, while students desiring to work as farmers and engineers and vocationally undecided students obtained the lowest scores.

Trait II (Status-need) did not discriminate significantly among the criterion groups. This finding was tentatively interpreted as reflecting the high level of variability in status needs within many occupational groups.

Trait III (Organization-need) also did not discriminate significantly among the criterion groups. However, students choosing occupations requiring scientific training scored significantly higher ($p < .01$) on this trait than did students choosing non-science careers. In addition, there was significantly less variability on Trait III among students selecting non-science careers.

None of the intercorrelations among the three traits was significantly different from zero.

The results of this investigation tended to support some of the previous research with work satisfaction. Moreover, considerable support was given to theories of occupational choice which emphasize motivational determinants of choice.

The findings of both the cluster analysis and the validity analysis were interpreted as partially confirming the two major hypotheses of this investigation.

Microfilm $2.00; Xerox $3.80. 68 pages.

PSYCHOLOGICAL CHARACTERISTICS OF ADOLESCENTS WHO HAVE HAD IMAGINARY COMPANIONS

(L. C. Card No. Mic 59-2835)

Ernest Frederick Bairdain, Ph.D.
Columbia University, 1959

PROBLEM AND HYPOTHESES

Differences in the literature on imaginary companions suggested the questions investigated in this study: Are there differences in psychological characteristics between subjects who did not possess imaginary companions and subjects who did possess imaginary companions? Is the intensity with which the imaginary companion was experienced associated with the presence or absence of differences?

It was hypothesized that subjects who recalled very intense imaginary companions (Intense IC), subjects who recalled imaginary companions of mild intensity (Mild IC), and subjects who did not recall imaginary companions (No IC), did not differ in: general intelligence, sexual interest patterning, interpersonal sensitivity and suspiciousness, unusual thoughts and actions, introversion, and dominance.

METHOD AND PROCEDURE

Four hundred and three high school students were given the MMPI and a questionnaire which contained questions of general interest and an a priori scale for rating intensity of imaginary companions. IQ's were available from school records.

Remembered imaginary companions were rated on a twenty point intensity scale. Intense IC, Mild IC, and No IC comparison groups were formed only of girls because of the small number of high-rated IC boys.

RESULTS AND CONCLUSIONS

The hypotheses were tested by means of equated IQ's and the Mf, Pa, Sc, Si, and Do Scales of the MMPI. An analysis of variance was made among mean raw scores on each MMPI scale and among equated IQ's for the three comparison groups of girls. All mean raw MMPI scores for all groups were within normal limits.

An F, significant at the 5% level, was found for the Mf and Sc Scales. Analyzed further, t's, significant at the 1% and 2% levels respectively, were found for No IC and a combined group of Intense IC and Mild IC girls. It was concluded that, in comparison with No IC girls, IC girls are more feminine in sexual interest patterning and are more characterized by unusual thoughts and actions.

No differences were found on the Pa, Si, and Do Scales

and for equated IQ's. It was concluded that adolescent girls, with and without imaginary companions, do not differ in interpersonal sensitivity and suspiciousness, introversion, dominance, and general intelligence (for the range of intelligence found in this study).

A small number of IC boys were compared to No IC boys. No differences were found and it was tentatively concluded that no differences existed between boys for the characteristics considered here.

The intensity with which imaginary companions were experienced did not seem to be a factor in the relationships considered here.

A correlation matrix for five intensity variables indicated that, while there are indications of some relationship of the factors of speech, visibility, occupation of space, and hearing, to the quality of intensity, the scale in its present form does not constitute a reliable four or five item scale.

Analysis of the background questions indicated that no differences existed between No IC and IC subjects in interests, preference for thought or action, and specific daydreams. A reliably larger percentage of IC subjects reported themselves as being more imaginative and remembered having played alone.

DISCUSSION AND SUMMARY

It was suggested that the results may be interpreted to reconcile apparent conflicts in the literature. Further research on the use of play with imaginary companions as a projective device was suggested.

Microfilm $2.00; Xerox $5.20. 103 pages.

A STUDY OF THE USE OF PSYCHOLOGICAL CONCEPTS, APPROACHES AND METHODS BY PASTORAL COUNSELORS

(L. C. Card No. Mic 59-2335)

W. John Cannon, Ph.D.
The American University, 1959

Chairman: C. K. Trueblood

The Purpose of the Study

It is an uncontroverted truth that a very high proportion of the population of the United States looks to the ministry for guidance and counsel. Yet only recently has the clergy given heed to the scientific principles of psychology as an aid in the discharge of this great responsibility. Church leaders are still restrained in embracing the useful training for counseling offered by psychological schools of thought. Facts are urgently needed which would give scientific data on the effects of psychological principles on counseling. It was the purpose of this study to make a pilot study in this uncharted area. It is to be hoped that this will stimulate further and wider studies on more representative samples.

The Plan

The study consisted of the presentation of the same three well selected case histories to each of twenty-two pastors who had received approximately one year's training in psychology, and twenty pastors who had received not more than six weeks training. The pastors were asked to respond to interview questions as if the case histories were counselees seeking the pastor's help. The interviews were tape recorded. The tape recorded responses were examined and compared so that the influence of training would be demonstrated particularly in the areas of diagnosis, prognosis and therapy. The case histories were categorized by experts as being ones of neurosis, maladjustment and psychosis respectively. This appeared to be a good test of the counselor's ability to recognize degrees of need. It was contended by the investigator that it is extremely important that the pastor should be able to recognize serious mental disorder when such cases presented themselves. He should know how to help those who came within the scope of his ability and training. He should know how to avail himself of the spiritual resources at his disposal in therapy. He should also be aware of such serious disorders that call for referral.

Results

The study gave striking differences between trained and untrained pastors. Most of the trained men recognized serious mental disturbances and saw the case of maladjustment as one for the pastoral counselor. Eighteen of the untrained men failed in this respect.

Likewise in therapy all of the trained men had a plan of approach and operated on scientific principles. Of the twenty untrained men eighteen had no systematic approach but just waited to see what would turn up. The results were disappointing in the areas of prognosis and the use of spiritual resources.

Microfilm $2.15; Xerox $7.60. 162 pages.

THE RELATIONSHIP OF DEPENDENCY TO VERBAL LEARNING WITHOUT AWARENESS

(L. C. Card No. Mic 59-2933)

Elaine Greenbaum Caruth, Ph.D.
University of Southern California, 1959

Chairman: Professor Jacobs

Recent investigations in psychology have demonstrated that individual patterns of verbal behavior may be modified in a predetermined direction, without the awareness of the subjects, by means of verbal and nonverbal reinforcement. Further research studied the individual differences in the degree to which subjects manifest such learning without awareness. The present study, one of the latter group, specifically hypothesized that the personality dimension of dependency was an important variable in the reinforcement of verbal behavior. Previous research had indicated that dependent individuals rely more heavily upon external cues for guiding their behavior than upon their inner resources. It was predicted that dependent individuals would similarly rely more heavily upon verbal reinforcement cues for guiding their response patterns, even though such reliance might be without their conscious awareness. Thus, it was hypothesized that there could be demonstrated a differential response

of dependent and independent subjects to verbal reinforcement of which they were unaware.

The present study employed a technique in which the subjects were presented with 80 3x5 cards consecutively. In the center of each card was typed one of 80 commonly used verbs. Six pronouns were placed below the verb and their respective order randomized for the series of 80 cards. The subjects were instructed to make up a sentence beginning with any one of the pronouns and using the verb typed on the card. A total of 100 subjects were used, divided into one control and four experimental groups of 20 subjects each. During completion of the task by the four experimental groups, the examiner verbally reinforced all sentences beginning with a first person pronoun, after the first 20 sentences, but remained silent throughout for the control group. The experimental groups were selected to investigate the variables of dependency, independency, status as a neuropsychiatric outpatient as compared with normals, and the relative effectiveness of "good" in a face-to-face situation as compared with "mm-hmm" with the subject seated with his back to the examiner, as a verbal reinforcer. Dependency and independency were empirically defined according to the Dependency Scale of the Minnesota Multiphasic Personality Inventory derived by Gordon.

The results of the experiment failed to demonstrate the principle of verbal reinforcement and further failed to confirm the hypothesis of a difference between dependent and independent subjects in their response to verbal reinforcement. There was no demonstrable difference in the response of normal and neuropsychiatric outpatient subjects nor in the response to the two different verbal reinforcers. All groups of subjects showed an over-all tendency to increase the number of first person pronouns used as trials progressed. The different groups of subjects showed a significant variation in their over-all use of the first person pronouns. The control group differed from all other groups with respect to their significantly more frequent use of the first person pronouns.

The writer concluded that there was a definite need for the publication of more exact specifications of experimental procedure and design before the results of one experiment could be reliably repeated by other investigators. The importance of the nature of the experimental setting, the instructions to the subjects, the role of the examiner in relation to the subject, the sex of the subject and examiner, and the properties of the individual interpersonal relationships between subject and examiner were discussed as potentially contributing to the apparently deviant results of the present study.

Microfilm $2.00; Xerox $6.00. 121 pages.

SOME EMOTIONAL FACTORS IN COUPLES PRESENTING A PATTERN OF HABITUAL ABORTION

(L. C. Card No. Mic 59-2659)

Dorothy Agnes Cole, Ph.D.
Syracuse University, 1959

The purpose of this research was to measure the emotional needs, characteristics, and coping mechanisms of couples who present a pattern of habitual abortion and to compare these emotional needs with those of couples who present a pattern of no abortions and two or more successful pregnancies and to identify the differences in emotional needs of husbands and wives in each group.

The three underlying assumptions of this investigation are that; 1) a relationship exists between the emotional pattern of women and the functioning of the endometrium and the outcome of pregnancy, 2) many differences in emotional characteristics between husband and wife may result in tension or stress, 3) the character of emotional differences between wife and husband is important, for some emotional combinations contribute to stress and some to harmony in the marital relationship.

The subjects in this investigation totalled 88. The Experimental group consisted of 23 habitually aborting women and their husbands; the Control group, of 21 non-aborting, non-pregnant multipara and their husbands. The wives in these groups were of comparable mean ages.

Twenty-one hypotheses were made concerning the emotional patterns of habitually aborting women, and their husbands, under four subject-comparison groups: 1) differences between Experimental and Control wives, 2) differences between Experimental and Control husbands, 3) differences between Experimental wives and their husbands, and between Control wives and their husbands, and 4) differences between the mean difference scores of the two groups of couples.

Five instruments were used to measure the emotional patterns of the subjects: the Saslow Screening Test, the Taylor Anxiety Scale, the Braen Self-Description Inventory, the Stern Activities Index, and the Rorschach Ink-Blot Test.

The results, shown by the three types of statistical analyses (t test for correlated means and for uncorrelated means and chi square), disclosed that:

1. Experimental and Control women, except for 4 significant differences, were very much alike in their emotional patterns.
2. Experimental and Control husbands were also very much alike except for 4 significant differences.
3. There seemed to be more grounds for stress and tension between mates in the Experimental group than in the Control group. There were 21 differences between Experimental husbands and wives and 15, between Control pairs. Cancelling out those needs on which both couples differed, there were 11 significant mean differences between Experimental couples and 5, between Control couples.
4. The emotional character of the needs on which the Experimental couples differed appeared to be more conducive to stress and tension than that of the Control couples. This tension, it was inferred, might be a factor, in conjunction with nutritional and biochemical factors, related to the malfunctioning of the endometrium and a consequent unsuccessful pregnancy.

The obtained results suggest that habitually abortive women may differ, not in emotionality, per se, but in their reaction to stress. Further investigation was urged: 1) of the subjects' reaction to stress, synchronizing psychological, biochemical and nutritional testing, and 2) of

the character of the needs on which couples differ in the marital relationship in order to find which emotionality combinations contribute to tension and which to harmony.

Microfilm $2.10; Xerox $7.40. 159 pages.

OBJECTIVE MEASURES OF PERCEPTION IN SCHIZOPHRENICS AND NORMALS

(L. C. Card No. Mic 59-2578)

Ruth Cooper, Ph.D.
Columbia University, 1959

This study was designed to investigate differences between normals and schizophrenics in accuracy and variability of judgment in simple, objective, visual tasks. The rationale was derived from literature which described schizophrenics as deficient in reality testing ability, and from perceptual theory which referred to perception as the individual's point of contact with reality.

The hypotheses presented for investigation were that: (1) the schizophrenic is less accurate and more variable in perceptual judgments than is the normal person; (2) there is a relationship between severity of illness and accuracy and variability of judgment.

The subjects were 66 psychiatrically hospitalized veterans who had been diagnosed schizophrenic, and 36 veterans hospitalized for medical reasons who were without past psychiatric referral or history. Neurological patients and patients with organic brain pathology were excluded from both groups. Subjects were controlled for age, level of education, visual acuity, and for ability to follow simple instructions. The psychiatric patients were rated for severity of illness on the Montrose Rating Scale.

Ss were required to make judgments about equality of line length on three instruments: (1) a Galton Bar adaptation; (2) a model of the Sander Parallelogram; (3) an assumed figure-ground instrument devised by Kunnapas. Judgments, except for those on the Kunnapas Squares, were treated as absolute errors. Average error and variance were computed for individual Ss and for each group. On the Kunnapas Squares, errors were weighted according to their distance from equality; number of reversals were counted as measures of variability.

The results supported the hypotheses that schizophrenics are less accurate and more variable than normals in judging objective visual stimuli. No relationship was demonstrated between ratings of severity of illness and accuracy on the three tasks. Suggestions offered to account for this lack of correlation were: (1) lack of proof of inter-judge reliability; (2) the hypothesis that perceptual impairment may operate on an all-or-none basis; (3) the incomplete representation of schizophrenics through the exclusion of regressed, untestable subjects.

The data were additionally analyzed to discover any relation between performance on the three tests. For the schizophrenics, three out of a possible six correlations were significant with respect to accuracy; for the normals, only the correlation between the Galton Bar and Sander Parallelogram accuracy scores was significant. Explanations were offered both for the presence and absence of correlations.

With respect to correlations in variability between tests, the normals showed significant correlations between all measures; the schizophrenics only between scores on the Kunnapas subtests. The implications of these findings were discussed.

Split-half reliabilities were computed for all measures. For the schizophrenics, all tests proved reliable; for the normals, all but the 9 cm. Kunnapas Squares were reliable.

It was concluded that the schizophrenics were considerably less accurate and more variable in judging objective visual stimuli than normals. Moreover, schizophrenic variability was so "variable" as to be unpredictable. No relationship was found between severity of illness and accuracy or variability of judgment.

It was further concluded that the results supported theories of reality testing dysfunction in schizophrenia. However, since the tasks were especially selected for simplicity of stimuli and straightforwardness of demanded response, and the testing situation was kept free from emotional threat, it was felt that cognitive and affective theories of schizophrenia, in and of themselves, could not completely account for the obtained differences between groups. The suggestion was offered that schizophrenia may also involve perceptual impairment.

Perceptual theory and research, which postulated a relationship between personality integration and perception, were also supported by the findings.

The potential of objective perceptual tasks as diagnostic and differentiating instruments was discussed.

Microfilm $2.00; Xerox $3.00. 60 pages.

PRESENT STATUS OF PSYCHOLOGICAL SERVICES IN STATE HOSPITALS AND TRAINING SCHOOLS IN PENNSYLVANIA

(L. C. Card No. Mic 59-311)

Grace Belden Cox, Ed.D.
Temple University, 1958

The purpose of this study has a four-fold aim:

1. To reveal the nature and extent of the existing psychological services in state hospitals and training schools in Pennsylvania.
2. This includes a review of the existing selection, classification, and training programs of clinical psychologists, the number required to meet expanding needs and the area of competency essential to the fulfillment of these needs.
3. To compare selected factors in the mental health program in Pennsylvania with those of Ohio, Massachusetts, California, and South Carolina; where recent efforts have been directed toward the improvement of such services in connection with the needs of the mentally ill and the mentally retarded.
4. To make suggestions and recommendations in an effort to improve the situation in regard to recruiting, classifying, and training of clinical psychologists.

In compiling the information required to compare

developments of Pennsylvania's psychological services with those of other states, data was obtained from welfare departments of the selected states, National indices, current material from State and Federal services and personal contacts made with staff directly responsible for psychological services.

The period covered in this study is primarily directed from the establishment of the Department of Welfare in 1921, to the present, although consideration is given to records beginning in 1676 when the Society of Friends in Philadelphia began a concerted effort in behalf of the mentally ill. It was not until 1845, however, that the Commonwealth assumed its first responsibility for the care of the "indigent insane."

In 1923 the Mental Health Act became effective due to legislative action. Several revisions have since been made. The General Assembly of 1955 changed the function of the Boards of Trustees of the 17 mental hospitals and four training schools for the mental defectives to advisory capacity instead of controlling, and established the office of Commissioner of Mental Health with the rank of Deputy Secretary in the Department of Welfare. He is responsible for the success and direction of the entire mental health program.

The results indicate that improved staffing of professional personnel since 1955 in Pennsylvania's mental hospitals has already demonstrated its effectiveness. Staff members, however, are still far below the qualitative and quantitative standards of the American Psychiatric and American Psychological Associations' standards. Substantial salary increases for clinical psychologists has placed Pennsylvania in a competitive position for the top positions.

In the way of innovations and changes considered desirable in the present mental health program of the Commonwealth of Pennsylvania, the writer would like to make the following suggestions or recommendations:

1. There should be a strong central administrative office.
2. Special emphasis should be given to the development of the department of psychology within the state services which can give the necessary adequate field experience as well as the needed field supervision for doctoral degrees.
3. Training programs for clinical psychologists in the state hospitals in connection with the colleges and universities should be expanded.
4. A fact-finding survey is recommended to be carried on cooperatively by the Bureau of Mental Health, the colleges and universities of the state and the American Psychological Association, with the aim of eliciting from potential and present sources of personnel what conditions would have to prevail to make state services in clinical psychology more attractive so that constructive changes could be made.
5. It is recommended that efforts be made to develop interest in college students majoring in psychology so that they may be attracted to State service upon graduation. To the same end, positions should be expanded for temporary, or part-time, employment of college students in the state hospitals under proper supervision. It is also recommended that the state hospitals establish more student-aid positions which would furnish room and board and a stipend to college students being trained in clinical psychology.

Microfilm $3.15; Xerox $10.80. 243 pages.

ROLES PLAYED BY COUNSELORS IN THEIR INTERVIEWS

(L. C. Card No. Mic 59-2555)

David Guild Danskin, Ph.D.
The Ohio State University, 1954

Within the last fifty years, counseling has become recognized more and more as an area of professional practice and study. Also, counseling has branched out and become an important activity carried on in schools, industry, government agencies and community services. However, knowledge about factors influencing the counseling interview and processes within the interview is still limited. Continued research needs to be conducted to make available more information about the counseling process.

Scientific studies of the counseling interview generally have followed three lines of interest. The first area to be studied was that of the diagnosis of client problems. A second area of study has been concerned with developing and evaluating theories of the treatment of individuals. The third area of study has attempted to determine some of the conditions making for optimum communication between counselors and clients.

These three areas are not separate discrete areas. They are interrelated, and knowledge in all three areas is necessary for good counseling. It is just as an aid to research that the three are studied somewhat independently. The present study has been interested primarily in the interaction or communication between the counselor and the client in the counseling interview.

Nearly all the research on the interaction between counselor and client has been concerned with the analysis of verbatim transcriptions of counseling interviews. The early studies were essentially methodological. After these early studies showed that counseling interviews can be analyzed quantitatively, researchers began studying counselor behavior. At first the main concern was with the analysis of single counselor speeches. Later research showed that counselors tended to vary their behavior when discussing different topics. For example, Elton [1] found that counselors handled skill and adjustment topics quite differently; their methods varied both in the amount of lead of their statements and in the amount of responsibility assigned the client.

In an analysis of larger units used in interview analysis, Muthard [2] found that the use of problem area and discussion topic units brings together similar behaviors and also sets off parts of the interview which are less related. In addition, he found that the use of discussion topic and problem area units makes it possible to identify shifts in counselor and client behavior. Muthard suggests that one of the bases for these shifts or variations in counselor behavior might be the roles which counselors

assume. The present study is an attempt to identify these counselor roles.

The primary concern of the present study, then, is the extent to which various counselor roles can be reliably inferred from verbatim transcriptions of counseling interviews. This involves two steps: (1) the location of transition points between counselor roles, and (2) the labeling of the roles played by the counselors between these transition points. In addition, several secondary questions are tentatively explored. These secondary questions are concerned with (1) certain characteristics of these counselor roles; (2) the relation of counselor role to the counselor technique of leading; (3) the relation of counselor role to the interview outcome of working relationship; and (4) the relation of the type of problem being discussed to the role the counselor plays and to the role the client expects the counselor to play.

MATERIALS

Interviews

Thirty interviews from counseling centers at five universities are included in this study (Chicago, Michigan, Minnesota, Missouri and Ohio State). The 30 interviews are divided equally among the five schools—three counselor-client interview series were selected at random from those available at each school for a total of fifteen different counselors and clients. Both an early and a late interview from the same counselor-client series were then selected in an attempt to include roles which might typically occur in only one part of an interview series.

Check List of Roles

The writer developed a check list to be used in labeling the counselor roles. The writer and three other graduate students assisted in devising the check list. All four have had considerable training and experience in counseling.

These judges were instructed to read fifteen interviews, not included in the final study, and describe the various roles they thought the counselors were playing. These lists of roles, plus previous research and "arm chair" consideration of counseling experience led to a tentative check list of roles. In addition, a manual was prepared including descriptions of each role and instructions for rating the role the counselor plays and the role the client expects the counselor to play.

The same four judges, after reading this newly prepared manual, then rated six additional interviews. These ratings, plus suggestions from the judges, led to a revision of the Manual of Instructions and to the formulation of the final form of the check list of counselor roles.

JUDGES

The writer and two other persons made all the role ratings in this study. All three judges have had extensive counseling experience. The training of the judges involved reading and discussing the Manual of Instructions for Judges, making practice ratings on interviews not included in either the development of the check list or final study, and discussion of practice ratings to clear up any misunderstandings.

Some of the ratings of counselor technique (amount of lead) and interview outcome (working relationship) were made by persons other than the three judges in this study. These other judges had had considerable training and experience in rating interview protocols.

OBTAINING THE DATA

Transition Point

In locating transition points, judges first read the Manual of Instructions prepared for this purpose. Then judges read each of the 30 interviews and designated for each interview the transition points, or indicated that no transition points were apparent. The order in which the interviews were rated was such that no two interviews by the same counselor or from the same school were rated consecutively.

A point in the interview was designated as a transition point if at least two of the three judges agreed in selecting this point as a transition point. Two ratings were counted as agreeing if the counselor statements designated as transition points by the judges were no more than three counselor statements apart, e.g., speech 30 and speech 32—agreement.

Counselor Roles

An average of three weeks after locating transition points, judges were asked to label the role played by the counselor in each role unit. The judges first read the Manual of Instructions for the rating of counselor roles. The role unit or units in each entire interview were rated, using a separate check list for each unit. The interviews were rated in the same sequence as that used in locating transition points.

At this time, judges also labeled the role the client expected the counselor to play.

Counselor Technique

Two judges independently rated each counselor remark for amount of lead, using a 50-point scale. That is, each counselor remark was rated in terms of its distance ahead of the preceding client remark.

Interview Outcome

Two judges independently rated the amount of working relationship for each role unit on a 50-point scale. Working relationship between counselor and client refers to the degree of mutual warmth and respect present, and the degree to which counselor and client pool their efforts in moving towards a solution to the client's problem.

Nature of the Client's Problem

The type of problem being discussed in each role unit was classified by judges as special, skill, adjustment or test interpretation.

CONCLUSIONS

The following tentative conclusions are suggested by the study. The conclusions are based on judgments made by reading verbatim transcriptions of counseling interviews.

Primary Conclusions

1. Judges can agree beyond chance on the location of transition points between counselor roles. In this sample of 30 interviews, judges agreed on 84 transition points. All three judges marked the same transition point 41 times

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and two of the three judges agreed on the location of transition points the other 43 times. To test the hypothesis of chance agreement, a chi square was computed and found to be 1326.8. This is sufficient to reject the hypothesis of chance agreement at the .001 level.

2. Judges can agree beyond chance in labeling the roles played by counselors between transition points. In labeling the 114 role units, all three judges agreed 64 times, two judges agreed an additional 44 times, and all three judges disagreed six times. A total of 236 pairwise agreements between judges were found. By chance one would expect an average of 44.2 pairwise agreements. The number of obtained agreements is 33.1 standard deviations beyond the number expected by chance. This is sufficient to reject the hypothesis of chance agreement at beyond the .001 level of confidence.

3. Transition points between counselor roles and transition points between discussion topics are related. The 30 interviews used in the present study were marked independently for transition points between discussion topics by three judges other than those involved in the study. In these 30 interviews a total of 114 transition points between 144 discussion topics were located, along with the 84 transition points between counselor roles. In 58 instances, the transition points between discussion topics and between role units agreed within two counselor speeches.

4. The data on the primary questions support the hypothesis that counselors play various roles within an interview. Such a list of counselor roles can be used to point up the variety of behavior that a counselor can use. This would be extremely useful in working with counselors-in-training who might be playing only one or two roles, or who may have no idea of the role they should play. Previous supervision of counselors-in-training has often dealt with the amount of lead in specific speeches. However, roles seem to give a much larger basis for making supervisory suggestions. Also, a list of counselor roles makes it possible to determine the situations in which the various roles might lead to optimum interview outcome. For example, certain roles may be most appropriate while discussing one type of problem and other roles may be most appropriate while discussing another type of problem.

Secondary Conclusions

The conclusions suggested in this section of the dissertation are very tentative because of the small number (only 30) of interviews sampled. Therefore, they are suggested mainly as hypotheses for future research.

1. Some roles occur significantly more often than other roles. A chi square was computed, comparing the number of times the roles occurred with the number of times the roles would be expected to occur by chance. The obtained chi square of 68.33 is significant at the .001 level; this would indicate that the frequencies with which these roles occurred probably was not due to chance.

2. There are no significant differences in the number of times roles appear in early and in late interviews. A chi square was computed to see if the observed frequencies with which these roles occurred in early and in late interviews was the result of chance. The obtained chi square is significant at between the .10 and .05 levels of confidence.

3. There is a relation between the type of client problem being discussed and the role the counselor plays. A chi square was computed on the data giving the role the counselor played while discussing various client problems. The obtained chi square is significant at beyond the .001 level; this would permit us to reject the hypothesis of chance relation between problem and counselor role.

4. Counselors tend to play a limited number of roles. While 10 different types of roles were found in these 30 interviews, no counselor played over 3/5's of them (i.e., 6 different roles). Two counselors played six roles, three counselors played five roles, four counselors played four roles, four counselors played three roles and two counselors played only two roles.

5. Counselors at different counseling centers emphasize different roles. The frequencies with which the different roles were played at the five counseling centers were tested for chance occurrence. The obtained chi square of 109,82 is significant at the .001 level; this would permit us to say that the frequency with which roles ocurred at the various centers probably was not due to chance.

6. The roles vary in length, as indicated by the number of counselor speeches. Differences in the lengths of roles occurring more than three times were tested for significance by Festinger's "d" technique. Generally, the tutoring, reflecting, participating and diagnosing roles did not differ significantly (at the .01 level) from each other, but they did differ significantly from the socializing, administrating and informing roles.

7. There are no differences between counselors in the average length of the roles they play; the average length of roles played by counselors from one school are not consistently different from the average length of the roles played by counselors from another school. The differences between the fifteen counselors included in this study were tested for significance by Festinger's "d" technique. No significant differences (at the .01 level) were found.

8. In summary of the factors influencing the role the counselor plays, the following conclusions are suggested, all of which need to be investigated by further research: Some roles occur significantly more often than other roles. There are no significant differences in the frequency with which roles occur in early and in late interviews. The type of problem being discussed influences the role the counselor plays. Counselors tend to play a limited number of roles, rather than a wide range of roles. Counselors from different counseling centers tend to play different types of roles. There are no consistent differences between counselors and between counseling centers in the ease with which roles are identified. In addition, the lengths of roles tend to vary significantly, but counselors do not differ in the length of roles they play. Research is needed to verify these suggestions. At present they are just guesses about factors which influence the dynamics of the interview.

9. There seems to be a relation between the role the counselor plays and the amount of counselor lead. Roles occurring eight or more times were tested for significant differences in amount of lead by Festinger's d technique. At one extreme, the reflecting role differed in amount of lead, at the .01 level, from all but the socializing role. At the other extreme, the informing and tutoring roles tended to differ significantly (at the .01 level) from the rest of the roles, but not from each other.

10. The various types of roles, in general, do not differ in average amount of counselor-client working relationship. Five of the roles were generally too short to be

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rated for amount of working relationship. The remaining six roles were tested for significant differences by Festinger's d technique. The only differences significant at the .01 level were between the reflecting role and the other five roles tested (tutoring, informing, diagnosing, administrating and participating).

11. A counselor may establish a good working relationship with a client even though the counselor does not play the role the client expects. The median amount of working relationship for the 80 role units in which the counselor played the role the client expected him to play was 29 (on a 50-point scale) as compared with a median rating of 34 for the seven role units in which the counselor did not play the expected role. This difference was not significant when tested by Festinger's d technique.

12. A counselor is less likely to play the role the client expects him to play while an adjustment problem is being discussed. In the seven instances in which the role the counselor played differed from the role the client expected the counselor to play, an adjustment problem was being discussed.

13. In summary, the data on counselor lead indicates that role units tend to bring together similar counselor behavior and set it off from parts of the interview which are less related. The data on counselor-client working relationship suggests that the various roles are similar, as measured by this dimension. The one exception is the reflecting role which has significantly higher ratings of working relationship. Is this role easier to play, or when a client is ready for it does he feel better rapport? Further research is needed to determine the reasons for apparent higher working relationship when playing the reflecting role. Data on the role the client expects the counselor to play indicate that counselors in this sample generally played the expected role. However, counselors may play a role different from that expected by the client and still retain good working relationship (especially when discussing adjustment problems). However, when should counselors play a role that differs from the one the client expects him to play? Should a counselor play many roles? These are questions that future research will have to answer. Microfilm $2.65; Xerox $9.20. 201 pages.

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2. Muthard, J. E. "The Relative Effectiveness of Larger Units Used in Interview Analysis," J. Consult. Psych., 18 (1953), pp. 184-188.

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THE INFLUENCE OF COLOR IN PROJECTIVE TESTING

(L. C. Card No. Mic 58-2439)

John Ernest Exner, Jr., Ph.D.
Cornell University, 1959

Chairman: F. S. Freeman

Four matched groups, each containing one hundred essentially normal subjects, were used in an investigation concerning the stimulus characteristics of color as applied in projective tests. Card I, of the Rorschach Test, and three chromatically colored derivations of it, created by the Monochrome Dye Coupling method so that size, form, shading and background were held constant, were used as materials in this study. Each card was assigned to one group and administered to the subjects in that group individually, using the standard Rorschach procedures. Responses were recorded verbatim. Statistical analysis of the data was accomplished using the Chi Square Method so that the data concerning response location, response determinant and response content of each group was compared with each of the other groups.

Three hypotheses were formulated and supported by the results of this investigation. They are:

1. Chromatic color has a significant influence on an individual's response to a perception regardless of his conscious awareness of the relation of the color to his response.

2. Achromatic color has a significant influence on an individual's response to a perception regardless of his conscious awareness of the relation of the color to his response.

3. Different chromatic colors have significantly different stimulus characteristics.

A global appraisal of the results suggests that Helmholtz's doctrine of unconscious inference is applicable to the explanation of the response process in projective testing. This appraisal also supports the theories of Schactel and Rickers-Ovsiankina concerning the immediacy of the Rorschach color response and points out significant differences in the degree of passivity to color as hypothesized by Shapiro. The results indicate the necessity of giving consideration to the color of the stimulus figure, when evaluating Rorschach responses and emphasize a need for more specific information concerning the actual stimulus characteristics of the cards used in the Rorschach Test.

Microfilm $2.00; Xerox $3.60. 61 pages.

ATTITUDES TOWARDS INTERPERSONAL COMMUNICATION, PERCEIVED DISSIMILARITY, AND ACCURACY OF INTERPERSONAL PERCEPTION AMONG PARENTS OF SCHIZOPHRENICS AND PARENTS OF NORMALS

(L. C. Card No. Mic 59-2580)

Murray Fisher, Ph.D.
Columbia University, 1959

The present study was designed to determine whether or not there are consistent and significant differences between parents of schizophrenics and parents of nonschizophrenics with regard to interparental communication. A review of theoretical and experimental literature led to the formulation of hypotheses that parents of schizophrenics are differentiated from parents of normals by (a) more negative attitudes toward verbal communication, (b) less accurate perceptions of each other, and (c) perceptions of greater dissimilarity.

The Ss were 30 pairs of parents of hospitalized male schizophrenics and a control group of 30 pairs of nonschizophrenics. They were asked to respond to a specially

constructed questionnaire and to a 200-word check-list. The questionnaire, which was found to be sufficiently reliable for group comparisons in terms of internal consistency, was designed to elicit information relating to attitudes toward verbal communication between husband and wife. Subjects answered individual items by indicating either strong or mild agreement or strong or mild disagreement. The check-list was used to obtain a measure of the degree of accuracy with which a husband and wife perceived each other, and to determine whether and how the groups differed with respect to similarity or dissimilarity of self-other perception. Each parent was asked to check those adjectives which described him or her and then, with a new check-list, to check the adjectives thought to have been checked by the mate.

Questionnaire scores consisted of the total number of "agree" (or "negative attitude") answers. Check-list scores were derived in percentages, in order to take into account the differences in number of adjectives checked by individual couples. The accuracy score for a given parent consisted of the number of correctly checked predictions for the mate divided by the total number of adjectives checked by the couple. The actual dissimilarity score was the number of adjectives checked by one parent but not the other divided by the total number checked by the couple. The perceived dissimilarity score was the total number of adjectives checked by a parent for himself but not for his mate, and for his mate but not for himself, divided by the total number of adjectives checked for himself and his mate.

The results indicated that there were no significant differences between parents of schizophrenics and parents of normals in terms of the hypotheses tested. The only difference to emerge was a qualitative one, with parents of schizophrenics checking significantly more adjectives independently judged as being "favorable." The lack of support for the hypotheses was considered as attributable either to (a) the complexity of interparental communication in relation to the instruments used to measure it, (b) the evocation of specific response tendencies by the instruments, and (c) the lack of any real differences between parents of schizophrenics and parents of normals in terms of the variables tested.

The findings were discussed in terms of their theoretical implications. Limitations of the conclusions with regard to the particular method and to the type of subject used were evaluated. Suggestions for further research were made with emphasis on different avenues of approach.

Microfilm $2.00; Xerox $4.20. 80 pages.

THE RELATIONSHIP OF SOCIAL ACCEPTANCE TO THE PERSISTENCE AND GRADES OF COLLEGE STUDENTS

(L. C. Card No. Mic 59-2739)

Jeanne Ermel Good, Ph.D.
The Ohio State University, 1959

The problem of predicting academic success has been the subject of a great deal of research, as has the nature of social acceptance among students, but the possible relationship between these factors has not been investigated. Sociometric data from three colleges were scored in three ways: total, same-sex, and opposite sex. Information regarding the subsequent academic history of 815 freshman students was obtained from the records of the three colleges. The four academic criteria used throughout this study were the number of semesters that the students remained in college, whether or not they graduated, their freshman grades, and their cumulative grades. Additional information regarding veteran status, fraternity membership, sex, and academic aptitude also was obtained and the data were punched on IBM cards. Hypotheses regarding the relationship of each of the three types of sociometric scores with the criteria were stated in the null form and tested by correlating the variables by using the original score formula. The statistical significance of the results was then determined.

The correlations of the total sociometric scores of freshmen at colleges A and B with measures of persistence were slight (.11 to .13), but statistically significant at the 5 per cent level of confidence. The correlations with grades also were low (.19 to .22), but statistically significant at the 1 per cent level. The correlations of the same-sex sociometric scores with persistence were significant only at school A (.14 and .15), whereas only at school B were the opposite-sex sociometric scores related to persistence (.11 and .13). There are indications that these differences are attributable to the varied housing, eating, and fraternity arrangements at the two schools.

When various subgroups of the student populations were studied individually, differences in the acceptance-persistence and acceptance-grades relationships appeared. Among male freshmen at college A there was a definite relationship between the number of votes that a man received (particularly from other men) and his persistence in college. A study of men who had not been in the armed services showed even higher correlations (.42 to .44) between total or same-sex sociometric scores and persistence at school A. The correlations of these sociometric scores with grades also were significant (.23 to .32). Among veterans, however, there were no significant positive correlations. The results of a study of men who were members of fraternities were very similar to those of freshman men in general.

The study of freshman women revealed no significant relationships between same-sex sociometric scores and persistence or grades in college. At one school there was an indication that persistence might be related to the number of friendship choices received from men. A separate study of sorority members revealed no significant relationships between acceptance and persistence or grades.

It was concluded that acceptance is related to the persistence and grades of college students and that this relationship persists after academic aptitude is held constant. However, although the correlations are statistically significant, they are too low for individual prediction when whole student bodies are considered. The correlations varied according to the type of sociometric score used, the college, and the characteristics of the student group being studied. Among some students, non-veteran men for example, the correlations appear to be of a magnitude which would be useful in the prediction of persistence in college. Microfilm $2.25; Xerox $8.00. 171 pages.

THE RELATIONSHIP OF NEEDS TO FRIENDSHIP CHOICES IN ADOLESCENCE

(L. C. Card No. Mic 59-2852)

Samuel Kahn, Ph.D.
Columbia University, 1959

The present research was designed to investigate the relationship between contrasting patterns of needs and different kinds of interpersonal relationships in late adolescence. The need patterns, similarity and complementarity, derived from two contrasting theoretical positions, similarity of attitude and complementarity of need. They were studied in relationship to types of sociometric choices ranging from mutually amicable to antagonistic in character.

The similarity of attitude theory holds that the possession of similar characteristics predisposes individuals to be attracted to each other to the degree that these characteristics are both observable and valued by those who observe them and was conceptualized in this study in terms of reported needs.

The complementarity of need theory is a motivational theory of selective interaction based upon the existence of complementary needs in the individuals involved and was defined in this study in terms of the degree to which certain kinds of needs in one person are being gratified by another person.

Nine specific research hypotheses were tested based on the following general hypotheses: (1) similarity of needs is related to sociometric choices among adolescents, and (2) complementarity of needs is related to sociometric choices among adolescents.

Friendship choices were measured with a sociometric questionnaire which was administered, in one high school, to the five brightest junior classes determined by grades and IQ scores. There were 134 Ss in the age ranges from 15 through 17. The instrument was designed to elicit choices on two important activities for adolescents: (a) eating lunch and (b) attending a school sporting event. The sociometric data were analyzed into the following choices: (a) positive mutual; (b) negative mutual; (c) indifferent mutual; and (d) positive one-way choices. These sociometric groups were divided into same-sex choices for boys and girls.

Needs were measured with the Edwards Personal Preference Schedule. Similarity was defined as the difference in similar needs as measured in two individuals and the following needs were used: Affiliation, aggression, autonomy, dominance, heterosexuality, and nurturance. Complementarity was defined as the difference in pairs of complementary needs as measured in two individuals and the following pairs of needs were used: Aggression-abasement, dominance-abasement, dominance-deference, and nurturance-succorance.

The hypotheses were evaluated by testing the statistical significance of differences between means of the various sociometric groups.

The measures of similarity, complementarity, and sociometric choice were found to be reliable. The positive reseults suggest that similarity discriminates between positive and negative mutual choices. Complementarity discriminates between negative and indifferent mutual choices.

The negative results show that similarity does not discriminate between positive and indifferent or positive one-way choices, nor between negative and indifferent choices. Complementarity does not discriminate between positive mutual and positive one-way choices. Similarity is not more influential than complementarity in a mutually positive relationship. Choices based on two sociometric criteria were not different than choices based on a single criterion.

The data in general suggest that neither similarity nor complementarity of needs appears to be particularly meaningful in the determination of adolescent friendships beyond the suggested importance of similarity in a case where an extreme difference in friendship choices exists. However, both of these need patterns are internally consistent phenomena and perhaps are related to other factors. Similarities in perceptual and cognitive phenomena appear to be promising leads for future research in this area.

Microfilm $2.00; Xerox $3.00. 44 pages.

NORMAL ELECTROCORTICAL ACTIVITY IN RELATION TO PERSONALITY FACTORS

(L. C. Card No. Mic 59-2386)

Edward John Kelty, Ph.D.
Duke University, 1959

Supervisor: Walter D. Obrist

This study was designed to examine individual differences in electrocortical activity among subjects with presumably normal functioning central nervous systems. Attention was drawn to striking differences in normal electroencephalograms, for example, 8 to 13 per second, sinosoidal alpha rhythms, in contrast to irregular, low voltage fast activity. It was proposed that such individual differences are related to various personality patterns.

Two basic personality factors were derived from a review of the literature on psychological correlates of electrocortical activity. The first factor is behavioral alertness, characterized by traits ranging from apathy and calmness to the extreme of tension and anxiety. The second dimension is behavioral expressiveness, characterized by varying degrees of control, extending from passivity, inhibition, and repression to impulsive, hypomanic, and aggressive states.

It was hypothesized that well-developed, slower alpha rhythms are associated with a reduced level of behavioral alertness and controlled behavioral expressiveness. It was predicted that decreased alpha activity of higher frequency occurs in tense, acting-out individuals who have excessive behavioral alertness and expressiveness.

The subjects were 85 male medical, surgical and psychiatric patients from 20 to 50 years of age. All had normal electroencephalographic tracings, and were able to read at the third grade level or better. None of the subjects had acute or chronic brain disorders, nor electroconvulsive or insulin therapy preceding the experiment. Forty-nine of the subjects did not receive any medications which might affect the EEG. The other patients were on relatively limited drug therapy, and showed no significant difference in alpha index from the non-drug group.

The majority of the subjects received the full procedure

consisting of an EEG recording under resting, attention, and simple visual stimulation conditions, as well as the Ohio Literacy Test, MMPI, Maudsley Medical Questionnaire, Inventory of Factors STDCR, and Passive-Dependency Scale. A sub-group was given a limited procedure including a resting EEG and the MMPI.

To test the relationship between individual differences in normal electrocortical activity and the two personality factors, the following specific hypotheses were made:

1. Alpha indices greater than fifty per cent are associated with limited behavioral alertness, as indicated by: (a) scores below the median on the Welsh A scale of the MMPI, and (b) scores below the median on the Neuroticism scale of the Maudsley Medical Questionnaire.
2. Alpha indices greater than fifty per cent are related also to limited behavioral expressiveness, as indicated by: (a) scores above the median on the Welsh R scale of the MMPI, (b) below the median on Guilford's Rhathymia scale of the STDCR, and (c) above the median on Kessler's Passive-Dependency Scale.
3. For alpha indices less than fifty per cent, the converse of the behavioral correlates in #1 and #2 above was predicted.

Analysis of variance techniques and t-ratios were used to test the significance of the differences. The major significant relationship was evaluated with linear and curvilinear correlations.

The principal finding was the objective demonstration of a relationship between a personality factor and alpha activity. A significant correlation of -.23 was obtained between Welsh A scores and alpha index. The relationship was most pronounced when alpha varied as a function of A scores, (eta = .72) but also occurred when alpha activity was the independent variable. The association between high A scores and low alpha indices on one hand, and between low A scores and high indices on the other, was present during all experimental conditions, e.g., resting, attention, and visual stimulation. The Maudsley Personality Inventory did not correlate with the EEG findings.

It was not possible to obtain objective evidence of the behavioral expressiveness factor with any of the tests used. This included the failure to replicate the correlation Kessler obtained between passive-dependency and alpha index.

The relative merits of applying two-factor personality theory to electrocortical relationships were discussed. Some neurophysiological parallels of the two behavioral dimensions were presented.

Microfilm $2.00; Xerox $3.80. 66 pages.

AN INVESTIGATION OF THE CONCEPT OF "BEHAVIORAL RIGIDITY" AS APPLIED TO A PENAL POPULATION

(L. C. Card No. Mic 59-2657)

Kurt Otto Konietzko, Ph.D.
Temple University, 1959

The purpose of this study was to investigate the concept of "behavioral rigidity", the consistency of its manifestation and its presence or absence as a definitive expression among inmates of a maximum security penal institution. It also sought to determine the relationship that exists between behavioral rigidity and such variables as age, intelligence, education, number of convictions, number of arrests, number of parole violations, and total accumulated time of institutionalization. The relationship of behavioral rigidity to personality characteristics was determined, as were differences in personality scores between the inmate sample and the normative sample. Differences between Caucasian and non-Caucasian subjects were noted because of their possible bearing on the problem of recidivism.

The sample of 150 inmates was selected via tables of random numbers and proportionally stratified according to race. The number of Caucasians and non-Caucasians equalled the proportion that was present in the prison population.

The subjects were literate, male, maximum security prisoners from primarily urban backgrounds with Intelligence Quotients of 80 or above, who were members of the general population and not enrolled in psychotherapy.

The records of each sample inmate were reviewed. Descriptive information and Stanford Achievement Test scores were secured. The subjects were administered the Revised Beta Examination, the Test of Behavioral Rigidity and the California Psychological Inventory.

Because of the nature of the sample and its limitations, no generalizations can be made as to general differences between Caucasians and non-Caucasians. Apart from these limitations the following conclusions may be made:

1. The inmate sample scored in the "average" range of intelligence. The Caucasians approximated the educational level of the general population, while the non-Caucasians scored 1.1 grades below them.
2. Compared to the normative sample, both groups received a "moderately rigid" classification. The largest difference between the groups was speed of performance and quickness of thinking.
3. When the Test of Behavioral Rigidity was utilized with the inmate sample, the factors appeared to retain their uniqueness.
4. The inmate sample, compared with the normative sample, scored significantly lower on 11 of the 18 California Psychological Inventory scales.
5. The non-Caucasians scored significantly different from the Caucasian group on six California Psychological Inventory scales (five lower, one higher.)
6. The Rigidity-Flexibility continuum was only slightly associated with age and total accumulated time of institutionalization.
7. Number of arrests, convictions and parole violations appeared to have no bearing on the degree of Rigidity-Flexibility present in the inmate.
8. The small relationship between race membership and Rigidity-Flexibility appeared to be primarily the result of the difference in Psychomotor-Speed scores that the two groups obtained.
9. When one of the variables was partialed out, the different patterns of relationships present between educational achievement, intelligence, and Rigidity-Flexibility in the two groups appeared to be the result of the different role educational achievement played in the groups, and the greater importance of the Psychomotor-Speed factor in the non-Caucasian group.
10. The small relationships between Rigidity-Flexibility and intelligence, educational achievement and intellectual

efficiency in the combined groups appeared to be largely the result of the Psychomotor-Speed factor.

11. Intelligence was slightly associated with intellectual efficiency in both groups, but intellectual efficiency appeared to be associated substantially with Flexibility only in the non-Caucasian group.

12. Flexibility appeared to be associated with different personality characteristics in both groups.

Microfilm $3.10; Xerox $10.60. 237 pages.

THE RELATIONSHIP BETWEEN EXPERIMENTAL VARIABLES AND THE OCCURENCE OF DUODENAL ULCER

(L. C. Card No. Mic 59-2687)

William W. Lothrop, Ph.D.
The University of Tennessee, 1959

Major Professor: Dr. Gerald R. Pascal

The present study is part of a larger research program with duodenal ulcer patients carried out at the Veterans Administration Hospital in Atlanta, Georgia. The purpose of this study was to investigate behavioral and environmental differences between duodenal ulcer patients and matched controls, and to derive tentative hypotheses regarding the relationship of these variables to the presence or absence of duodenal ulcer. Five hospitalized ulcer patients with histories of medical and surgical intractability and five hospitalized veterans without ulcer, matched by pairs on age and education, served as Ss. In view of the confusion existing in this area of research, this study attempted to stay as close as possible to a systematic, behaviorally-oriented approach, using a behavior rating scale devised by Pascal and Jenkins.

A total of 263 variables relating to past or present behavior and environment were examined for consistent differentiation between the ulcer patients and controls throughout the five matched pairs. Of these discrete behavioral variables, 22 were found to be significant at or beyond the .10 level of confidence, some of which overlapped others and some of which were of questionable validity, so that caution is advised in drawing inferences about their relationship to duodenal ulcer. Scores on a Deprivation Scale constructed by Pascal and Jenkins from earlier work in the research program, however, gave non-overlapping distributions, with the ulcer patients obtaining the higher scores. This finding is significant at the .005 level of confidence by the t-test, and is interpreted as suggesting that the ulcer patients in this sample are experiencing more deprivation in their current environments than the controls.

An attempt was made by E and another judge to derive learned attitudes and expectancies from the data pertaining to the Ss' early childhood environments. No significant differences between the ulcer patients and their controls were found, but consistency among the ulcer patients themselves was found on two such constructs, a datum which is significant at the .03 level by the Binomial Expansion. It has been hypothesized that the ulcer patients in this sample should have learned feelings of inadequacy and to expect to fail in some aspect of the masculine role. Secondly, it has been hypothesized that the ulcer patients should have learned to perceive mother as non-succorant, and to expect to obtain little or no gratification of succorance or dependency needs from her. The relationship of these findings to other research literature was discussed, and several very tentative hypotheses were offered as possible subjects for further research. Suggestions for refining the methods of collecting and analyzing the data were also made.

Microfilm $2.00; Xerox $5.00. 100 pages.

RESPONSE EVALUATION OF A BOYS' INDUSTRIAL SCHOOL SAMPLE, A DETENTION HOME SAMPLE, AND A PUBLIC SCHOOL SAMPLE TO A MODIFIED NEEDS QUESTIONNAIRE

(L. C. Card No. Mic 59-2746)

Nathan Morris Lubin, Ph.D.
The Ohio State University, 1959

The present study was concerned with discovering whether or not a needs questionnaire geared for delinquent populations would be responded to in a discriminatory manner by delinquent and non-delinquent samples. Items for the needs questionnaire were obtained by administering a Three Wishes Questionnaire to the white male resident population of the Juvenile Diagnostic Center, Columbus, Ohio. Four psychologists of the Juvenile Diagnostic Center served as judges in placing items into need categories. Agreement of at least three of the four judges on the need category to which an item belonged determined retention of items for the final form of the needs questionnaire. Lucas' six orthogonal need factors constituted the basis for judging items.

Three samples were used. A boys' industrial school sample was intended to measure the effect that a combination of delinquency and institutionalization might have on responses to the needs questionnaire. A detention home sample consisting of first time adjudicated white males was used to determine the effect of initial adjudication on responses. A public school sample was used as the control non-delinquent sample. The variables of sex and race were controlled by the limitation of samples to white males. Rural-urban influences were controlled by restricting the samples to subjects with residence in communities of one hundred thousand or more population. The three samples were matched for chronological age, intelligence quotient as obtained on the Revised Beta Examination, and parental occupational status. The scale originally developed by Warner, Meeker, and Eells was used for evaluating occupational status of the parents. Each of the three equated subsamples consisted of fifty-one subjects.

The hypotheses underlying the research were--

1. That there will be differentiating responses between a non-delinquent sample (public school sample) and two delinquent samples (institutional sample, detention home sample).

2. That delinquents, because of a general characteristic of perceiving themselves as not gaining need satisfaction, will respond to the needs questionnaire in a manner suggesting this lack of need satisfaction. In contrast, the non-delinquent sample will respond to the needs

questionnaire in a manner suggesting either a lack of concern for the need or a condition in which the need is being satisfied.

3. When comparing an institutional delinquent sample with a sample composed of children who have been adjudicated delinquent for the first time (detention home sample), the institutional sample will react to the needs questionnaire with a larger number of responses indicating lack of need satisfaction than will the detention home sample.

The six need factors and the forty-nine items for each of the three subsamples were evaluated for differences between the response categories. When a factor or item proved to be statistically significant, the modal response class was used as a basis of comparison to show the manner in which the three subsamples responded to the factor or item. Item eight for the detention home subsample was the only item which did not prove to be statistically significant.

On the basis of the statistical evaluation, the three hypotheses were not upheld. Although not significant, a trend was noted in relation to the third hypothesis. Two items only were involved; however, it was found that this hypothesis was reversed. The delinquents who were adjudicated for the first time reacted to the items with goal-seeking responses, while the institutional delinquents reacted to the items with goal-attaining responses.

Microfilm $2.00; Xerox $6.60. 138 pages.

PERSONALITY CORRELATES OF PEPTIC ULCER PATIENTS

(L. C. Card No. Mic 59-2861)

Simone Verniere Marshall, Ph.D.
Columbia University, 1959

The purpose of the present study was to investigate the defensive behavior pattern proposed by Alexander as characteristic of the ulcer patient in his handling of unconscious dependency needs. The existence of dependency needs was assumed, and the hypotheses tested concerned only the pattern of defenses against the realization of these dependency needs. The general hypothesis was derived from Alexander's theory, while the experimental hypotheses were based on a review of the clinical cases presented by Alexander and his followers.

It was hypothesized that ulcer patients would describe themselves as being more efficient, responsible, dominant, self-sufficient, achievement-oriented, aggressive, moralistic, emotionally inhibited, conforming and resistant to change, but less intraceptive and self-accepting. In order to determine whether ulcer patients were characterized by the above variables, 40 peptic ulcer patients were compared to 20 non-gastrointestinal psychosomatic patients and to 40 non-psychosomatic patients. Two measuring instruments, the Edwards Personal Preference Schedule and a specially designed rating scale, the Peptic Ulcer Index, were administered to the experimental and two control groups.

The results did not consistently support the defensive pattern proposed by Alexander in that peptic ulcer patients as compared to non-ulcer patients did not express significantly stronger needs for achievement, dominance, aggression, responsibility, efficiency, self-sufficiency. Also there was no statistical difference between experimental and control groups in relation to strict moralism, resistance to change and self-ideal discrepancy. The ulcer patients, however, did describe themselves as more emotionally inhibited, more conforming and less intraceptive than control patients.

The present findings suggested that ulcer patients may attempt to ward off the realization of their dependency needs by (1) an avoidance of insight into their motives and feelings, (2) an inhibition of expression of their emotional needs, and (3) an uncritical acceptance of social demands. Dependency needs are defended against, yet partially satisfied through behavioral patterns which include personal and social constriction in the service of acquiescence to formalized social demands.

The results of the present study were interpreted in terms of a shift in socially desirable patterns of behavior. Alexander's ulcer patients were viewed as inner-directed and governed by the Protestant Ethic while the ulcer patients of the present study were considered to be other-directed and dominated by the Social Ethic. The constant element in the ulcer patient's clinical portrait appeared to be his persistent need to follow closely the socially sanctioned set of values.

Microfilm $2.00; Xerox $3.60. 62 pages.

COMMUNICATED ANXIETY IN A TWO PERSON SITUATION

(L. C. Card No. Mic 59-2863)

Patrik Owe Mattsson, Ph.D.
Columbia University, 1959

This study was designed to produce an interpersonal situation where communication of anxiety as well as relief of anxiety (comfort) could be demonstrated. The conditions under which such communication could take place were derived from interpersonal theories of anxiety, and incorporated into the experimental design. It was hypothesized that (a) a person who interacts with a more anxious person will himself become more anxious, and that (b) a person who interacts with a less anxious person will himself become less anxious.

Subjects, who were male college students, were randomly paired and assigned to an experimental session or to either of two control sessions. All of the pairs were asked to perform a cooperative work task, a puzzle, the purpose of which was to provide an appropriate means of bringing the partners together in interpersonal interaction. In the experimental session, one subject received electric shock while his partner received no shock. The purpose of the shock was to introduce anxiety. The extent to which this anxiety was communicated was measured in three ways, i.e. changes in blood pressure, finger sweat, and scores on a rating scale. The reliabilities of the instruments were high ($r = .99, .90$, and $.88$ respectively). The validity for the physiological measures was based upon previous research, and for the questionnaire, taken at face value.

The first hypothesis was tested by comparing the anxiety change of the nonshocked subjects in the experimental

session with anxiety change of nonshocked subjects in a control session where no subject was shocked. The data supported the hypothesis for all three measures of anxiety. The second hypothesis was tested by comparing the shocked subjects of the experimental group with shocked subjects in a control group where both members received shock. The findings here did not support the hypothesis for any anxiety measure used.

It appears that the experimental design had less power to show communication of comfort than communication of anxiety. This lack of power could have been due to several considerations: (a) the cues of comfort, that were to be communicated to the anxious subject, were not strong enough; (b) the level of anxiety in the control subjects, against which the communicated comfort was compared was not high enough; and (c) feelings of comfort cannot be communicated as easily as feelings of tension. An additional possibility has to do with the receiver of comfort cues. In contrast to the receiver of anxiety cues, who was nonanxious subject, the receiver of comfort cues was anxious. In Sullivanian theory, the perception of anxious people is impaired, suggesting for this study that the cues of comfort, weak as they already may have been, could not be received.

An additional finding was that the measures of anxiety did not correlate with each other for the groups of anxious subjects. Where minimal anxiety was present, i.e, in the control group where no shock was given, significant correlations were, however, evident. This finding, interpreted in terms of Sullivanian theory, would suggest that the impaired perception in anxious people of their own anxiety cues, prevents the correlation of physiological and psychological measures of anxiety.

In conclusion, this study, within the limits of the operations, experimentally verified the Sullivanian concept of "empathy," i.e. the communicability of anxiety in an interpersonal setting.

Microfilm $2.00; Xerox $3.60. 63 pages.

THE EFFECT OF THORAZINE AS COMPARED TO ELECTROSHOCK THERAPY

(L. C. Card No. Mic 59-1760)

James Belser Morris, Ph.D.
The Florida State University, 1959

The purpose of this research project was to investigate, within a limited area, the treatment of acute schizophrenic reactions with Thorazine as compared to that of electroshock therapy and a control group receiving a placebo. Thorazine, the trade name of Chlorpromazine Hydrochloride, is one of the first tranquilizing drugs introduced into this country. A review of literature indicated a definite need for a controlled experiment using a placebo group and objective psychological measures to better determine the effects of Thorazine.

This experiment was performed at the Milledgeville (Georgia) State Hospital. Forty-five white male patients, received at this hospital for the first time and tentatively diagnosed as acute schizophrenics, were equated for age and IQ and assigned to three treatment groups. Each group consisted of 15 subjects; one to receive Thorazine, another to receive electroshock, and the third to receive a placebo. The dosage was considered a medical problem and was not handled by this experimenter.

Each subject was evaluated in 28 ways before treatment, and similarly evaluated 60 days after the initial treatment. The measurements consisted of a Psychiatric Behavior Scale, 11 objective measurements from Eysenck, 11 scales of the MMPI, and five measures from the Wechsler-Bellevue Scale.

A factorial design, using repeated measurements on the same subjects, was employed to determine the significance of each measure. Fifteen factors were found to be significant between the before and after treatment measures; 12 at the .01 level and three at the .05 level. Four factors were found to be significant at the .05 level between the three treatment groups.

All three groups showed a significant improvement between the before and after treatment measures, but no significant differentiation was made between the three treatment groups. A closer inspection revealed an approximately equal improvement for the Thorazine and electroshock groups, and a somewhat greater one than for the placebo group.

Three hypotheses were proposed at the beginning of this experiment. The first hypothesis, that Thorazine would be a more effective treatment than electroshock, was rejected. The second, that Thorazine and electroshock therapy were significantly more effective than a placebo, was conditionally rejected on the grounds that a slight difference did exist. The final hypothesis, that a controlled experiment would not substantiate elaborate claims made for Thorazine, was accepted.

Microfilm $2.00; Xerox $3.00. 40 pages.

A FACTOR ANALYSIS OF THE STANFORD-BINET SCORES OF MENTALLY DEFECTIVE CHILDREN

(L. C. Card No. Mic 59-2907)

Stanley Leo Nale, Ph.D.
The Pennsylvania State University, 1959

The investigation herein described is concerned with a general factor and with specific factors of intelligence. The distinguishing qualities of the factors obtained from an analysis of the Binet items given to endogenously mentally defective children are of primary consideration. A multiple factor theory, or a theory of general intelligence, may be more or less applicable depending upon the groups on which the analysis is applied. Chronological age, sex, race, and intelligence may be considered as the most common identifiable characteristics for grouping.

Statement of the Problem

Factorial investigations have used intelligence tests which represented the performances of average groups. The present factorial study, the first applied to mentally defective subjects, is needed in order to provide a factorial structure that is descriptive of the endogenously mentally defective group. The literature provides information that permits the writer to construct a set of

expectations relative to the outcomes of this factorial analysis. It is a point of interest to compare the expected results with the actual outcomes. Comparisons will be made with the results of the analyses on average groups relative to the generality, specificity, and names of factors. Inspection should reveal the tests that are stable in their factorial definitions. Sex differences in the nature and number of factors will be reported and the relation of chronological age to each of the rotated factors may provide some evidence relative to the hypothesis that intelligence becomes more differentiated with increasing age.

Procedure

The responses to the six, seven, and eight-year Binet tests of 599 endogenously mentally defective children were recorded as passed or failed. These dichotomies were placed in four-fold contingency tables. A matrix of phi coefficients was derived for males, N = 370, females, N = 229, and both sexes, N = 599. Six factors were extracted for each group. The project was programmed by the electronic digital computer at The Pennsylvania State University. The method of principal components was used. Thurstone's[1] rotational method for multidimensional configurations was applied to each set of factors. The defining tests for each primary factor were taken directly from the rotated matrices. Spearman's[2] single factor formula was used for ascertaining whether one common factor was sufficient to account for the correlations between primary factors. The saturation of each factor and each test with the second-order general factor was computed in order to complete the objectives of the investigation.

Results

The factors were named according to the content of the defining tests. Space, verbal reasoning, verbal, number, and memory factors were named for both sexes. Each primary factor was heavily saturated with a second-order general factor. The writer was able to anticipate the appearance of the primary factors. The general factor was also expected but its location as to primary or second-order level was not predicted. The sex differences relative to factorial structure were not anticipated. Several tests were stable in that they defined identically named factors on two or more of the analyses that were used for comparisons. Marked similarities in names of factors present evidence in the direction of similar factorial structures for average and endogenously mentally defective children. The primary factors in the present study were not identical for males and females. Chronological age showed some relation to the verbal aspects of mentation but there was little evidence for the support of the differentiation hypothesis.

Microfilm $2.00; Xerox $4.20. 79 pages.

1. Thurstone, L. L. Multiple Factor Analysis. Chicago: University of Chicago Press, 1957. 194-224.

2. Thurstone, L. L. Spearman's Single Factor Formula. In L. L. Thurstone, Multiple Factor Analysis. Chicago: University of Chicago Press, 1957. 275-278.

SOME CORRELATES OF DISTORTION IN THE PERCEPTION OF SELF-BLINDNESS

(L. C. Card No. Mic 59-2866)

David Gordon Oliensis, Ph.D.
Columbia University, 1959

Some correlates of distortion in the perception of severity of self-blindness were investigated in this study. Eighty-six blind adolescents and young adults responded to the Fitting Adjustment Scale and a Perceived Severity of Blindness Scale. Distortion in perception of blindness was computed on the basis of the relationship between perceived severity and objective severity of blindness. In addition, Ss responded three times to a set of descriptive words and phrases, indicating How I would be with normal vision, How I am now, and My idea of the ideal person. Disparagement of the present self and of the sighted self were rated according to the number of discrepancies between the ideal and each of these aspects of self-concept.

Two hypotheses were confirmed. Exaggeration of self-blindness was found positively related to maladjustment to blindness, and to the tendency to disparage the present self.

Five hypotheses were not confirmed. No relationship was established between exaggeration of self-blindness and the tendency to disparage the fantasied sighted self. No relationship was established between denial of self-blindness on the one hand, and maladjustment to blindness, disparagement of the present self, or disparagement of the fantasied sighted self on the other. Nor was any relationship established between distortion in the perception of the degree of self-blindness and three situational factors: objective degree of blindness, duration of blindness, and degree of association with other blind persons.

The findings were further analyzed with respect to chronological age and mental development.

The results were discussed in terms of the self-concept and adjustment of the disables, rehabilitation work, and further research.

Microfilm $2.00; Xerox $3.00. 56 pages.

FACTORS ASSOCIATED WITH THE QUALITY OF SELF-EVALUATIONS

(L. C. Card No. Mic 59-2592)

Phoebe Lucille Overstreet, Ph.D.
Columbia University, 1959

If self-attitudes are learned from various life experiences, self-evaluations should be related to variables which reflect pertinent experiences. Furthermore, self-evaluations and other variables which may have been affected by the same experiences should be related. Accordingly, it was hypothesized that the quality of an individual's self-evaluations is positively related to: (1) the quality of his parents' evaluations of him; (2) the degree of his acceptance by his peers; (3) his intelligence; (4) his academic achievement; (5) his socioeconomic status; and (6) his psychological adjustment.

Subjects of the study were 58 boys selected from the

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142 boys in the ninth grade of the Middletown, New York, high school who were participating in the Career Pattern Study.

Data for assessment of self-evaluations were obtained by content analysis of a series of recorded interviews with the boys. Three self-evaluative measures were used: SE General, which included various self-evaluations of a non-academic nature, such as evaluations of peer relationships, ability in sports, and the self as a whole; SE School, which included self-evaluations pertaining to academic progress, potential, and relations with school personnel; and SE Total, which included all self-evaluations regardless of area.

Similar measures were obtained by content analysis of recorded interviews with the subjects' parents, to assess the quality of the parents' evaluations of their sons. Measures of evaluations by both parents, by fathers, and by mothers, were studied.

Other variables were assessed as follows: peer acceptance by a Guess Who test; intelligence by the Otis Quick-Scoring Test of Mental Ability, Gamma; academic achievement by the average of grades in three required courses; socioeconomic status by the level of father's occupation as rated on Hamburger's revision of the occupational scale from the Warner Index of Status Characteristics; and psychological adjustment by the high school forms of the Mooney Problem Check List and an adaptation of the Rotter Incomplete Sentences Blank.

Hypotheses were tested by correlating the three self-evaluative measures with each of the other variables and determining whether the correlation coefficients differed from zero in the predicted direction at the .01 level of significance.

The subjects were classified according to interviewer into two groups of 33 and 25 boys, designated Groups A and B. On the average, subjects in Group A scored slightly higher than subjects in Group B on most of the variables in the study. Hypotheses were tested with data from all 58 subjects taken together, designated Total Group, and with data from Groups A and B taken separately.

Hypothesis 1 was partially sustained. Quality of self-evaluations was, in general, significantly related to quality of parental evaluations in the Total Group and in Group A, with the General and Total measures. In the General area, fathers' evaluations were more highly related to their sons' self-evaluations than were mothers' evaluations. The hypothesis was not sustained with evaluations in the School area, and it was not sustained in Group B with any of the measures.

Hypothesis 4 was partially sustained. Quality of self-evaluations, as assessed by the SE School measure, was significantly related to academic achievement in the Total Group and in Group B. The hypothesis was not sustained with General or Total self-evaluative measures, and it was not sustained in Group A with any of the measures.

Hypotheses 1 and 4 were each partially sustained in the particular group in which the self-evaluative measure with which significant correlations were found was most reliable.

None of the other four hypotheses was sustained.

Microfilm $2.30; Xerox $8.00. 173 pages.

EFFECTS OF PROBABILITY OF MISINFORMATION AND NUMBER OF IRRELEVANT DIMENSIONS UPON CONCEPT IDENTIFICATION

(L. C. Card No. Mic 59-1754)

Vladimir Pishkin, Ph.D.
University of Utah, 1959

Chairman: Lyle E. Bourne, Jr., Ph.D.

The primary purpose of this study was to investigate the effects of probability of misinformative feedback (MF) and number of irrelevant stimulus dimensions on a concept identification performance. A second aim was to test the purported hypothesis that probability matching occurs in partial reinforcement conditions. The use of MF in this study produced a situation, to a degree, similar to a partially reinforced guessing game. The experiment was designed so that aspects of Restle's theory of selective learning and cue validity could be tested.

The S's task was essentially that of learning to classify geometric patterns according to experimentally defined relevant dimensions. One hundred and eighty volunteer students from introductory psychology courses served as Ss. They were divided in order of appearance into 45 groups of 4 Ss, 2 males and 2 females. Each S served individually and the 45 groups represented the 45 different treatment combinations determined by 5 degrees of MF (i.e., 0%, 10%, 20%, 30%, and 40%); 3 different problems (dimensions relevant to solution), and 3 levels of complexity (1, 3, and 5 irrelevant dimensions).

An analysis of variance was performed in order to assess the significance of each of the main effects. The following conclusions were made from this analysis: 1) The main effects of MF and Complexity acted to significantly inhibit performance under all other conditions of the experiment. These factors were further tested by orthogonal polynomial analysis, with a result that only the linear component of each was significant. 2) As expected, Trials effect was significant in decreasing number of errors in performance. 3) Both the Problems and the Sex variable had no significant affect on acquisition of appropriate responses. 4) With the exception of two deviating conditions, the probability matching hypothesis was supported. 5) Theoretical analysis of data was carried out in terms of Restle's model. The relationship between the reciprocal of θ, a learning rate parameter, and the number of irrelevant dimensions was shown to be consistent with predictions. The comparison of obtained and predicted errors revealed large discrepancies. Explanations were offered for this inconsistency in terms of certain unexpected inversions in the data and certain unwarranted assumptions in the cue validity formulation.

Microfilm $2.00; Xerox $3.00. 46 pages.

RELATIVE EGO-INVOLVEMENTS OF CHILDREN AND ADOLESCENTS MEASURED BY ESTIMATES OF PERFORMANCE

(L. C. Card No. Mic 59-2073)

William M. Prado, Ph.D.
The University of Oklahoma, 1959

Major Professor: Dr. Muzafer Sherif

The purpose of this study was to compare the relative ego-involvements of children and adolescents with their fathers and friends, in which ego-involvement was measured by estimates of performances in an unstructured task situation.

Questionnaires were administered to male children (ages 8 to 11) and adolescents (ages 14 to 17) in order to select individuals having valued fathers and friends. Twenty-five child and twenty-five adolescent units were chosen. Each unit consisted of a child (or adolescent), his valued father, and the child's (or adolescent's) valued friend. The study was explained to the subjects as an investigation concerning eye-hand coordination. The task consisted of a dart-throwing game in which the participants could not view their actual performances because a screen was in front of the target. Father and friend threw darts over the screen while the child (or adolescent) estimated what score he thought each made. After the dart-throwing, a check list was used to elicit the kinds of current associations the child (or adolescent) had with his friend.

The results obtained indicated that children and adolescents differed significantly in their estimates of fathers' and friends' performances. Children estimated their fathers' performances to exceed significantly those of their friends, whereas adolescents estimated their friends' performances to exceed significantly those of their fathers. These results supported the hypotheses of this study and were in agreement with developmental findings that children are relatively more ego-involved with their parents than with their friends, whereas adolescents are relatively more ego-involved with their friends than with their parents.

The differential estimates of fathers' and friends' performances were not considered a function of the selection procedures since the children and adolescents showed much similarity in their responses to father and friend items on the questionnaires.

According to the check list used, the adolescents had significantly more current associations with their best friends than did the children with theirs. This finding was interpreted as support of the adolescents' greater ego-involvement with their friends than children with theirs.

Task and interview impressions were used to consider some of the factors which may have influenced particular children and adolescents to give estimates of performance which were not in line with the general trends obtained.

In conclusion, the results of this study, using estimates of performance, were in agreement with the general findings of developmental psychology concerning the relative ego-involvements of children and adolescents. Implications for reference group theory were discussed. Suggestions for research were proposed in which the sample and procedures used in this study could be extended to provide additional information concerning the operation of particular variables. Microfilm $2.00; Xerox $4.20. 78 pages.

OPERANT CONDITIONING IN A QUASI-THERAPY SETTING: THE INFLUENCE OF INTERVIEWER REINFORCEMENT UPON SUBJECTS' SELF-REFERENCE VERBALIZATIONS

(L. C. Card No. Mic 59-2826)

J. Maurice Rogers, Ph.D.
Stanford University, 1959

Problem

The purpose of this experiment was to test the hypothesis that an interviewer can produce changes in a subject's self-reference verbalizations in quasi-therapy by employing simple reinforcing behavior and that such simple reinforcements can alter a subject's concept of himself, as measured by personality tests.

Procedure

The experiment consisted of setting up a quasi-therapy situation in the laboratory by conducting a series of free-interviews with individual subjects in which operant self-reference verbalizations were reinforced with a simultaneous "Mm-hm" and head-nod. All interviews were tape recorded. A battery of four personality tests, two designed to induce "set" and two chosen as measures of anxiety and emotional adjustment, was administered prior and subsequent to the "therapy". Finally, a structured interview, likewise tape recorded, was conducted to ascertain the subject's awareness of the conditioning.

Subjects were 36 male university students in an introductory psychology course, randomly assigned to two experimental groups (one conditioned for positive and the other for negative self-references) and to a control group (not conditioned). A total of 216 ten-minute "therapy" interviews (6 per subject) were recorded and a detailed content analysis of self-references was made. Scoring reliabilities were established by correlating ratings of independent judges. Statistical procedures utilized in analyzing findings were t-tests and product moment and rank-difference correlation coefficients.

Results

1. Operant conditioning of verbal behavior in a quasi-therapy situation was demonstrated by establishing beyond the .01 level of confidence that negative self-references could be increased by interpolating simple reinforcing stimuli and that such conditioning could be accomplished without the subject's awareness. It was further shown, beyond the .01 level of confidence, that whereas positive self-references without reinforcement tended to extinguish themselves in quasi-therapy, with reinforcement their extinction could be arrested, this too without the subject's awareness.

2. Conditionability was not related to initial level of either anxiety or emotional adjustment.

3. Successful conditioning of self-references in "therapy" did not modify self-references outside of "therapy" or alter scores on tests of anxiety or emotional adjustment, indicating that the effect of the reinforcing stimuli was confined to "therapy" itself.

4. Consistency of personality was shown by the subjects' unconditioned responses in "therapy" and in psychological tests.

Conclusions

Since a major concern of psychotherapists is the

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patient's verbal behavior, it is imperative that the determiners of such behavior be systematically identified and assessed. The experimental demonstration of significant alterations in subject self-reference verbalizations as a direct result of simple interviewer reinforcements without accompanying personality changes (as measured by psychological tests) raises important questions as to the meaning characteristically attributed to such verbalization changes in psychotherapy, namely, that they signify personality modification. It seems proven that some aspects of the complex phenomena represented by psychotherapy are amenable to behavioral analysis and experimental manipulation. Further experiments utilizing operant conditioning designs are indicated. Extension of such experimentation to psychotherapy itself may be feasible.

Microfilm $2.00; Xerox $5.40. 108 pages.

EFFECT OF GROUP COUNSELING WITH MOTHERS ON THEIR ATTITUDES TOWARD CHILDREN AND ON THEIR SONS' READING DISABILITY: AN EDUCATIONAL-THERAPEUTIC APPROACH TO PARENT ATTITUDES AND READING DISABILITY IN A CLINIC SITUATION

(L. C. Card No. Mic 59-2086)

Milton Russell, Ph.D.
New York University, 1959

Chairman: Professor Brian E. Tomlinson

This study was designed to test two hypotheses: Group counseling of mothers of boys retarded in reading affects the mothers' attitudes toward children; and contributes to reading improvement in sons.

From among mothers expressing willingness to enter group counseling, two groups were formed, by random selection, Experimental, and Control I. A third, Control II, was composed of mothers refusing counseling. For each mothers' group was a corresponding group of their sons, all of whom were retarded in reading, but not in intelligence, of pre-high school age.

Treatment for all boys was identical - remedial reading instruction. Mothers in Experimental Group received group counseling. Other mothers received no special treatment.

Boys were tested for reading level, pre and post. Mothers filled out attitude questionnaires, pre and post. Mother-child relationships were rated by three judges, initially through case data (interviews, psychological examinations), finally through structured re-interviews. Notes taken immediately after each group session were used for qualitative analysis.

Experimental and Control Group I of boys made significant reading gains, t- tests indicated. No evaluation of reading gain for Control II was possible since variance differed significantly, F- tests showed.

Considering initial and final reading scores of the three groups, analysis of covariance showed an F- ratio of .818, which was not significant. Change in reading level among groups, due to the experimental factor, group counseling of mothers, did not affect dependence of final scores on initial scores.

Utilizing t- tests, no significant change in attitudes of mothers to children was found within any group. Nor did groups differ from one another significantly in attitude change.

When direction of attitude change is ignored, and only amount of change considered, the Experimental Group showed considerably greater change than the other groups; and Control Group I changed more than Control Group II, as determined through chi squares. The inference is that counseled mothers became courageous enough to express negative attitudes on the questionnaire.

Judges' ratings of mother-child relationships proved unreliable, the three judges differing considerably. Furthermore, F- tests showed significant changes in variance, preventing adequate comparisons.

Correlations between attitude gain and reading gain showed no high correlation for any group. However, when correlations were computed between attitude change without regard to direction of change (negative or positive) and reading gain, a significantly high correlation (.83) resulted in the Experimental Groups, low correlations in Control Groups. These findings support the hypotheses, that group counseling contributes to change in mothers' attitudes and to sons' reading progress.

Qualitative judgment of group sessions suggest certain inferences: Mothers vary considerably in degree of emotional involvement in counseling; mothers explored many subjects, primarily concerning children, but ranging broadly; considerable information regarding children's development was explored, but effects of additional knowledge upon mothers were not ascertained; most mothers became less anxious as problems were shared, and some directed hostility away from sons and toward husbands, encouraging more realistic husband-wife interaction; sons' reactions to changes in mothers varied greatly, from improved relations generally, to open rebelliousness in heretofore passive children; maturer behavior in sons was observed even when mothers' attitudes changed toward the negative; mothers' personality problems dating from childhood affected relations with sons, and probably sons' reactions to learning; all boys appeared deeply involved with their mothers, with great tensions apparent; the boys had universally poor relationships with their fathers, characterized by formality and distance, contempt, fear and withdrawal or sharp rivalry; no boy appeared to have a solid identification with his father.

A need for research to determine effects of father-son relationships on sons' behavior and learning was indicated. Microfilm $3.35; Xerox $11.40. 260 pages.

ASPECTS OF REGRESSION AND THEIR RELATIONSHIP TO EMPATHY: AN INVESTIGATION INTO CONDITIONS OF PERSONALITY ORGANIZATION RELATED TO EMPATHIC ABILITY AMONG NORMAL AND SCHIZOPHRENIC ADULTS

(L. C. Card No. Mic 59-2091)

Irving Steingart, Ph.D.
New York University, 1959

The general hypothesis tested was that empathic ability would be positively related to an ability to regress in

the service of the ego. It was theoretically assumed that regressive inclinations were more likely under ego control within the normal personality, and out of ego control within the schizophrenic personality. It was predicted, therefore, that normal individuals who demonstrated high degrees of empathic skill would also demonstrate significantly higher degrees of regressive inclinations, compared to normals who possessed little empathic skill. It was further predicted that schizophrenic individuals who possessed high degrees of empathic skill would demonstrate significantly lower degrees of regressive inclinations, compared to schizophrenics who possessed little empathic skill.

Empathic ability was defined as a form of accurate non-language communication. Thirty engravings served as the non-language medium, depicting individuals in a variety of situations as part of one unfolding story. A standard interpretation was obtained for each engraving by consensual agreement between the artist and a group of psychotherapists presumed to be skilled at non-language communication. Each subject successively chose that one interpretation, of four alternative interpretations presented for each engraving, which he believed best conveyed the meaning of the story. A graphic play (finger-painting) production, and a make-believe story (dream completion) task, were used as the materials from which an assessment of behavioral and ideational regressive inclinations in the personality was made. The finger-painting and dream completion products of each subject were rated on a six point scale, by two judges, according to pre-established characteristics of regressive action and thought.

Ninety-seven subjects served as the normal population, students in Psychology and Education at City College. Forty-six equated patients at Rockland State Hospital comprised the schizophrenic population. High empathy skill and low empathy skill groups were established for each diagnostic population by virtue of extreme scores on the empathy measure, were equated for certain control variables, and each contained fifteen subjects. The Kilmogorov-Smirnov non-parametric statistic for significance of maximum cumulative step difference between two distributions was systematically applied to differences in the regression rating distributions of the empathy skill groups, within each diagnostic population and between diagnostic populations. The six point regression rating scale was dichotomized and the Chi-Square technique was used to evaluate the frequency with which both judges agreed as to whether a given production contained high or low amounts of regression. Judge reliability for each regression measure was also evaluated by calculating for each empathy group the number of subjects for which both judges' regression ratings were no more than one rating unit apart.

The major findings were: (1) Empathic ability appeared positively related to an ability to regress in the service of the ego. Confirmation of the two specific hypotheses, although not at a significant level, appeared in three out of four experimental instances. The only experimental instance not in the direction expected by hypothesis involved also the only notable instance of judge unreliability. (2) Normals demonstrated significantly greater empathic ability than schizophrenics but this finding was questioned due to various limitations in the empathy measure. (3) Schizophrenic empathy groups demonstrated significantly less regression in behavior, and more regression in their thinking, compared to normal groups. (4) The data suggested that females possessed greater empathic skill than men. Empathic skill, and the concept of regression in the service of the ego, could be related to sexual identity and socio-economic variables. Also the concept of regression in the service of the ego could be related to types of perceptual flexibility and insight learning. Microfilm $2.00; Xerox $6.80. 142 pages.

A STUDY OF THE RELATIONSHIP BETWEEN VISUAL-PERCEPTUAL ABILITY AND SELECTED PERSONALITY VARIABLES IN A GROUP OF CEREBRAL PALSIED CHILDREN

(L. C. Card No. Mic 58-2311)

Matthew James Trippe, Ph.D.
Syracuse University, 1958

Supervisor: William M. Cruickshank

Problem--To study the relationship between visual perceptual ability and selected personality variables in a group of cerebral palsy children. In this study, visual perception is viewed as related to figure-ground functioning. The hypothesis is that the inability for figure to achieve salience over ground in visual perception results in inattention to irrelevant, extraneous stimuli, impairment of the individual's ability to respond to appropriate environmental cues, impairment of social learning, anxiety, and impulsivity.

Procedure--A population of cerebral palsy children ranging in ages from 8 to 12, with I.Q.'s above 75 were examined, using the Syracuse Visual Figure-Background Test. Two groups of thirty children each were then selected, matched for age and sex, and differing in visual perceptual ability. One group was formed from upper end of the distribution of scores, and the second from the lower end of the distribution of scores. To these children, the Rorschach Test, the Blacky Test, and a Projective Sentence Test were administered. Differences between the two groups of children on the scores resulting from these tests were then compared. For each score, a prediction was derived, based upon theoretical considerations as to the effects of a disturbance in Figure-Ground functioning.

Results--The analysis for each of the predictions indicated no differences between the two groups not to be accounted for by chance alone. Thus, on the basis of the variables studied, the instruments used, and the methods of analysis, no support for extending the notions as to the effects of a figure-ground disturbance in visual perception to the area of personality was found.

Microfilm $2.50; Xerox $8.80. 192 pages.

PSYCHOLOGY, EXPERIMENTAL

AN INVESTIGATION OF FIGURAL ALTERNATION IN VISION

(L. C. Card No. Mic 59-2548)

Edgar Alva Chenoweth, Ph.D.
The Ohio State University, 1954

It has been known for a long time that if one visual field is presented to one eye, while a sufficiently different field is presented to the other eye, most observers will report seeing a field which is in a continual state of fluctuation. First one view and then the other appears to be more or less dominant.

Welcker[1] described rivalry in 1852 in a discussion of "Irradiation." He felt the obvserved changes were due to fluctuations of attention. In a discussion of "prevalence and contest of contour," Hering[2] used illustrations taken from Panum to demonstrate rivalry. He felt that "parts of the background adjacent to the contour are predominant over the corresponding parts of the other retina, and suppress the perceptions stimulated by it."

While many investigators have observed rivalry, few have felt it played an important role in perceptual and visual skills. However, some have felt it has been a neglected factor. Washburn,[3] for example, has suggested that rivalry occurs in the ordinary perception of solid objects, and that it is a contributing factor to stereopsis.

Other investigators have raised the question of whether there is ever complete fusion of the right- and left-eye views. Neuhaus[4] attempted to show that the two retinal excitations do not merge into a single pattern of activity, but maintain their independence, with first one dominating and then the other.

Verhoeff[5] has emphatically denied the term fusion. He maintained that "replacement," either partially or completely, in which first one image and then the other is dominant goes on all the time. Clark[6] in investigating the relationship between eye movement and stereoscopic vision, concluded that, "clear perception may be binocular, but for a great part of the time it is monocular, i.e., the clear perception shifts from one eye to the other."

Aside from its implication for a general theory of perception, the investigation of binocular rivalry has clinical applications. It is frequently noticed that individuals who have poor visual skills, i.e., poor stereopsis, vertical and lateral phorias, low amplitude in terms of lateral break and recovery points, etc., have low rates of alternation. Following corrective measures, or visual training, the rate of alternation frequently increases.

The role of rivalry in a general theory of perception is not clear. Its relationship to other visual skills is not known. The proper evaluation of the role of rivalry requires additional factual information concerning the conditions which allow rivalry to be observed and the factors which influence it.

The general orientation of the present investigation is the point of view that rivalry is not a unique perceptual phenomenon which only comes to the foreground under specific experimental conditions. The investigator feels that in general the pattern of alternation and the rate of alternation will be influenced by well-known principles of perceptual and figural organization. The aim of the investigation is to gain a better understanding of rivalry and its relationship to perceptual theory and other visual phenomena.

Three problems are investigated. The first experiment delineates the conditions under which alternation can be observed. The stimulus configurations were presented in the Renshaw Stereo-Disparator to four observers. They contained contours which either intersected, just touched, or were spatially separated. The subjects were requested to observe the superimposed figures carefully and to report what they saw.

The second problem is derived from pertinent observations which suggest the existence of a type of rivalry that is subsidiary to binocular rivalry. Under appropriate conditions, rivalry will occur between patterns which have as their components, parts of both the right- and left-eye views. This may be thought of as figural alternation. It is subsidiary in the sense that a binocular pattern of alternation, i.e., fluctuation between a right- and left-eye view, occurs normally. In some instances, however, the binocular pattern may break down.

The problem may be stated as follows: "Is it possible to construct configurations which progressively favor figural alternation instead of a binocular pattern of alternation?"

The stimulus configurations were presented to five observers in the same apparatus as before. They were constructed so as to progressively favor alternation between patterns which had as their components, parts of both the right- and left-eye views. Both binocular and figural rates were recorded.

The third problem stems from the results obtained in the previous one and from suggestions in the literature which indicate that binocular rivalry is primarily a figural process. As such, it should be related to the laws of perceptual organization.

The following general question is raised: "What influence does the degree of perceptual organization within the stimulus configurations have on the rate and pattern of alternation?"

Wertheimer,[7] in a discussion of the laws of organization of perceptual forms, speaks of what he calls "The Factor of Proximity." The influence of proximity, in terms of the degree of perceptual organization within the configurations, is selected to be investigated because it can be easily quantified. This is done by using parallel, vertical lines for one view and horizontal ones for the other view. The lines are formed by dots. Proximity is varied by systematically increasing the distances between the dots from solid black lines to a point where it becomes extremely difficult to determine the orientation of the lines. In other words, the lines, as a unit, become perceptually weaker and lose directionality. This is dependent not only on the distances between the dots, but also on the distances between the lines as well. Those elements which are relatively close together spatially will be grouped and perceived as an integrated unit to the exclusion of other elements. The points of separation are at those positions where relatively greater distance occurs.

The figures were presented in a modified stereoscope to four observers. Rates of alternation and the accumulated temporal durations of the individual phases were recorded.

The following conclusions are drawn from the results of the three problems investigated:

1. Rivalry occurs when contours from the right- and left-eye views intersect in the superimposed view, but can not be observed when there is no contour interference.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

2. Alternation is more complete when one view is a closed figure, but this may be the result of the greater number of points of interruption in the contours.
3. Contours do not have to actually intersect, but will alternate partially if they are in close proximity; i.e., the adjacent portions alternately fade out and reappear. The entire contour seldom disappears.
4. Under appropriate conditions figural structure will dominate the binocular organization. When these prevail, alternation becomes largely figural.
5. Patterns of both binocular and figural alternation may be observed within the same configuration.
6. Destroying the unity within the individual views while increasing the cohesiveness of the patterns composed of parts of both the right- and left-eye views decreases the rate of binocular alternation and increases the frequency of figural alternation.
7. The rate of figural alternation decreases when figural organization is weakened within the configurations.
8. The temporal duration of dominant right- and left-eye phases remains the same when organization is decreased.
9. Cross-hatching phases, i.e., when neither view is dominant, become more frequent and of greater temporal duration when proximity is increased.
10. Some individuals can tolerate poorly structured configurations to a greater extent than others. Their rates do not drop as rapidly or as far when the degree of perceptual organization in the visual field is progressively decreased.

Microfilm $2.00; Xerox $5.00. 96 pages.

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A STUDY WITH PROJECTIVE TECHNIQUES OF SOCIOMETRICALLY HIGH AND SOCIOMETRICALLY LOW CHILDREN

(L. C. Card No. Mic 59-2539)

Ruth Laubgross Sherman, Ph.D.
University of Maryland, 1958

Supervisor: Richard M. Brandt, Associate Professor

The basic problem of this study was to determine whether projective testing could reveal any significant psychological differences between a sample of sociometrically high and a sample of sociometrically low children; and whether the sociometrically high children showed significantly better adjustment. A sociometric test was administered to nine, randomly selected classes from the fourth, fifth and sixth grades. Fifteen children with the highest number of choices and fifteen with the lowest number were selected for further study.

The selected children were all within the average range of intelligence, were matched according to age, had no gross physical defects and were not new entrants in the class. Both groups were given a Rorschach and cards A_2, A_3, A_5 and B, of the Symonds Picture Story Test.

The data were analyzed in three ways: (1) a summary of the central tendencies of the single variables; (2) a chi square test for significant difference between the groups in regard to specific Rorschach patterns associated with good adjustment; (3) a chi square test for significant differences in regard to signs of maladjustment. The maladjust signs were assigned a value of one to three.

The Symonds material was interpreted by means of an adaptation of the Murray method. The ratings of three judges were compared with those of the examiner. Those items which did not meet stated criteria of objectivity because of insufficient judge and examiner agreement were eliminated. The scores of both groups were tested for significant difference.

The findings revealed significant difference between the groups on three of the Rorschach formulations. The high status group had significantly less Ad + Hd than the low status group; less incidence of shading shock; and greater incidence of FM C' + c. Approaching significance, was the high status group's use of more of the color than achromatic determinants and higher S. On the third level of analysis, the low status group showed significantly more signs of maladjustment than the high status group. On the Symonds Picture Story Test, the low status group produced significantly more themes with a feeling tone of anxiety and a fear of competition than the high status group. Approaching significance, was the low status group's greater indication of hostility.

These findings can be interpreted to mean that the high status group tended to be more spontaneous and vital; less critical of self and others; less anxious and more capable of coping with competition. As a whole, the low status group showed significantly less adequacy in the mobilization of defenses in allaying anxiety.

The evidence revealed a relationship between basic personality and peer status. It tends to support the thesis that the mode of social interaction is not a separate behavioral segment, but an expression of the unified and consistent total self system. Low peer status seems to serve as a sign post of general disequilibrium.

The why of low group status was not shown to be lack of social need, but, rather, a general disruptive personality pattern which obstructs satisfactory implementation of the need. The findings imply that peer acceptance is not likely to be effected by the mere acquisition of skills or even specific attributes, deemed valuable by the adult society. It seems to be not the skills or attributes that earn a child high status, but, rather, his self acceptance and his psychological equilibrium through which he is able to communicate to others that his skills and attributes are valuable.

Microfilm $2.00; Xerox $5.80. 118 pages.

THE EFFECTS OF LESIONS IN THE CAUDATE NUCLEI AND DORSOFRONTAL CORTEX ON THE ACQUISITION AND EXTINCTION OF AN AVOIDANCE RESPONSE IN CATS

(L. C. Card No. Mic 59-2601)

Robert L. Thompson, Ph.D.
Columbia University, 1959

The effects of graded, bilateral, subtotal lesions in the caudate nuclei and dorsofrontal cortex upon the acquisition, extinction, retraining, and further extinction of an avoidance response in cats were investigated. The study was designed to add quantitative behavioral observations to the striatal syndrome described by Mettler, and to help clarify the role of the striatum in avoidance behavior.

The avoidance response consisted of crossing a 6 inch high partition between the chambers of a double-grill box in response to a 10 second auditory warning signal (metronome), terminating the warning signal and preventing shock which followed failure to respond within the 10 second interval. Extinction began on the 16th day following completion of the acquisition phase. On each trial the warning signal was terminated upon the occurrence of a partition-crossing response. By definition, shock was never presented in the extinction phase. Retraining to the earlier acquisition criterion followed achievement of an extinction criterion. Following retraining, a second extinction phase in which the warning signal remained on without regard to the subject's behavior was carried out.

Caudatectomies were performed in two stages. The first stage consisted of dorsofrontal decortication, involving the anterior third to half of the lateral gyri and underlying structures down to the level of the corpus callosum.

Prior to the initial acquisition phase, 15 cats were unoperated, 24 sustained dorsofrontal decortication, 6 were caudatectomized, and 3 had extensive dorsofrontal decortications. Acquisition began on the 15th postoperative day for cats with pre-acquisition surgery. Post-acquisition surgery was performed on the day following attainment of a pre-extinction (overtraining) criterion. Following acquisition, 7 unoperated cats sustained dorsofrontal decortication, 16 decorticates and the 3 extensive decorticates were caudatectomized, and 1 decorticate sustained additional dorsofrontal decortication. Damage to the heads of the caudate nuclei ranged from less than 10% to about 90%.

Pre-acquisition caudatectomies involved up to about 30% of the nuclei and showed no marked effects relative to dorsofrontal decortication.

Dorsofrontal decortication resulted only in slightly lowered resistance to extinction after both acquisition and retraining.

With respect to avoidance behavior acquired after dorsofrontal decortication but prior to caudatectomy, resistance to extinction, number of trials required for retraining, latency of escape responding in retraining, and post-retraining resistance to extinction appeared to be functions of caudate lesion magnitude. Small lesions resulted only in low resistance to extinction prior to retraining. Larger lesions further reduced resistance to extinction and also retarded retraining. With damage to over 50% of the caudate nuclei, a deficit in retention of escape behavior was suggested by an increase in escape response latency. Ablation of 80 to 90% of the caudate nuclei was associated with failure to achieve the retraining criterion in 1020 trials, and, in one case, complete failure to perform avoidance behavior.

Caudate ablations encroaching upon the thalamus, lenticular nuclei, and possibly other subcortical areas resulted in apparent failure to relearn avoidance.

Relevance of the results to the description of the striatal syndrome, and to the interpretation of some studies of frontocortical and rhinencephalic ablations was discussed.

It was suggested that the striatum is a major link in the neural mechanisms underlying the behavioral control exerted by discriminative and reinforcing stimuli generated by the postures and movements of the organism, and that striatal damage be viewed as in some way disturbing the controlling functions of behavioral feedback.

Microfilm $2.00; Xerox $5.80. 120 pages.

PERFORMANCE IN A MOTOR SKILL TASK AS A FUNCTION OF CHANGES IN RATE OF ACCOMPLISHMENT FEEDBACK

(L. C. Card No. Mic 59-2753)

Paul Ernest Torgersen, Ph.D.
The Ohio State University, 1959

Knowledge of results may take many forms in a skilled motor task. In the broadest sense, knowledge of results may refer to any mechanism which informs a combination decision-maker-controller of past performance or a function thereof, thereby permitting future courses of action to benefit from this past experience. In this broad sense, any servomechanism presupposes the existence of knowledge of results, i.e., feedback. The field of experimental psychology is rich in reports of experiments which include human operators, a task, and the feedback of some form of knowledge of results. The distinction has not been made in the literature, however, between knowledge of results in this broad sense and the specific feedback of score of past and current performance. It has been inferred that the specific feedback of score and the resulting competition against one's own record is a motivational cue and any resulting improvement in performance should be attributed primarily to an increased desire to perform well.

Feedback of score is the variable that was investigated in this study. The name suggested for this specific type of knowledge of results is "accomplishment feedback." Specifically, this study assessed the relative effect upon performance of some rates of accomplishment feedback and some changes in rate of this reinforcement during performance. In addition, the study illustrated that by the judicious selection of rates of accomplishment feedback it is possible to develop a preliminary model of some wage incentive plans in industry and thereby simulate work under these plans against the criteria of productivity and cost. The basic argument to support this contention is that the wage incentive scheme offers money as a reinforcement to work, and since accomplishment feedback offers score as a reinforcement to performance, the latter may serve as a laboratory model of the former.

Subjects were required to perform in a compensatory tracking task. When the response was within a preset tolerance about the null position, the subject was reinforced by the scoring of a decade counter which was located within the subject's field of vision. Two scoring circuits were incorporated in the apparatus and used as indices of the subject's performance. These indices were the percentage of time on target and the absolute integrated error. Subjects performed for fifteen trials of one minute duration each, and data were recorded for each trial. In addition, intratrial scores were taken on some of the latter trials.

The analyses of the data revealed that those groups that received accomplishment feedback of (a) constant four scores per second of time on target and (b) two scores per second changing to four scores per second, performed significantly better than all other groups. In turn, those groups that received (c) constant two scores per second of time on target, (d) constant one score per second, and (e) two scores per second changing to one score per second, performed significantly better than the two remaining groups of (f) two scores per second changing to no reinforcement and (g) a control group receiving no score reinforcement. The intratrial analyses of data revealed no significant changes in performance within trials with the exception of group (f). The performance of this group deteriorated significantly during the latter half of the trial.

The validation of the above schedules of reinforcement as a model of some wage incentive schemes was made difficult by limitations in the measurement of the industrial phenomena. The model was offered as an exploratory investigation and it was only able to be tested against two criteria: production in an incentive vs. no incentive environment and performance deterioration with time in the case of no incentive.

Microfilm $2.00; Xerox $5.80. 117 pages.

NOXIOUS AUDITORY ENVIRONMENT AND PSYCHOMOTOR PERFORMANCE

(L. C. Card No. Mic 59-2617)

W. Agib Trembly, Ph.D.
University of Southern California, 1959

Chairman: Professor Warren

This study was designed to investigate the relative influence of different types of sound and of different patterns of interruption of the sound upon the performance of a psychomotor task when the task itself was varied with respect to whether the subject or the experimenter determined the rate of the required reactions.

In order to ascertain the effects upon psychomotor performance associated with exposure to noise under the aforementioned environmental and task conditions, a laboratory study was designed and executed. The subjects, 108 male students between the ages of 18 and 30 years, were required to insert a stylus into one of a number of holes as they moved past a narrow slot in the cabinet which contained the apparatus. The holes, each of which could be identified by a surrounding symbol, were located on the surface of a drum which revolved continuously during the procedure. Performance on the task was quantified by recording both the number of errors made and the total time required to complete the task.

The environmental and task conditions were manipulated by the experimenter as follows: (1) The sounds, all of which were presented at a sound pressure level of 95 decibels relative to a reference level of .0002 dynes per square centimeter, varied in frequency. A pure sine wave tone of 210 cycles per second and a pure sine wave tone of 3,000 c.p.s. along with broad-band white noise were presented. (2) The pattern of interruption of each type of sound was varied so that the subject received it in continuous form, at a regularly interrupted rate, and at an irregularly interrupted rate. (3) The task presented to the subject was varied such that under one mode of presentation the individual proceeded to make responses at a rate determined solely by his own correct responses, while under the other configuration he was directed to respond at a rate determined by the experimenter.

Three separate analyses of variance of the data were performed: (1) in terms of errors made, (2) in terms of time required for completion of the task under self-pacing (responses determined by the subject himself), and (3) in terms of time required for completion of the task under external pacing of responses (responses determined by the experimenter).

Conclusions. The results of this study lead to the following summarized conclusions: (1) A tone of 210 cycles per second is associated with a greater decrement in performance than either white noise or a 3,000 c.p.s. tone. (2) A tone of 3,000 c.p.s. is associated with a greater number of errors, while white noise corresponds to a longer period of time required to complete the task. (3) In terms of time to complete the task, an irregularly interrupted noise compared with a regularly interrupted or continuously presented noise corresponds to the greatest decrement in performance under both self-pacing and external-pacing conditions. (4) Under self-pacing of responses a regular mode of interruption is associated with a greater decrement than continuous noise, while under

external-pacing conditions the two patterns of interruption are reversed relative to their association with larger decrement. (5) External pacing of responses corresponds to the greater decrement in terms of errors as well as in time required to complete the task. (6) A greater variability is associated with the condition of external pacing, especially in the case of time required to complete the task. (7) There are no important interaction effects upon performance relative to exposure to the various combinations of type of noise, pattern of interruption, and the pacing of responses.

Microfilm $2.00; Xerox $6.00. 125 pages.

THE EFFECT OF CUE CHANGE AND DRIVE ON A RUNNING RESPONSE

(L. C. Card No. Mic 59-2689)

Warren A. Young, Ph.D.
The University of Tennessee, 1959

Major Professor: Dr. W. O. Jenkins

This study attempted to test the hypothesis that cue change, in the absence of any known primary or secondary reinforcers, is a sufficient condition for the reinforcement of behavior. The behavior selected for manipulation was the forward running response of the albino rat. The learning situation was a simple one, involving two compartments separated by a guillotine door. The primary measure of learning was the time taken by Ss to approach and enter into the second compartment after the door had been raised. A trial consisted of allowing the S to "explore" the second compartment for sixty seconds, after which he was returned to his home cage. The apparatus was constructed in such a manner that visual and spatial cues could be added to the second compartment to provide varying amounts of change with respect to the first compartment. Three situations were created providing conditions of small, moderate, and large cue changes. A group of ten albino rats was assigned to each of these conditions and given one test trial a day for eighteen days.

Pilot studies with satiated Ss indicated a high operant level of approach-avoidance responding to conditions of moderate and large cue changes. In the present study, half of the Ss in each condition were placed on a 23-hour food deprivation schedule and half on an ad lib. schedule. The deprived Ss were not fed for at least thirty minutes after completion of a trial.

After the satiated animals in the small-change condition and the deprived animals in the large-change condition had reached an asymptote of acquisition (trial 18) they were inter-switched and given twelve post-test trials.

On each trial the Ss were detained in the first compartment of the apparatuses for ninety seconds. During this interval, the amount of gross bodily activity and the amount of time spent in the region of the guillotine door were recorded for each S.

The major findings are as follows: 1) All groups of Ss showed definite signs of acquisition although satiated groups were significantly more variable in performance than deprived groups. 2) Within the satiated groups no differences in running-speed emerged as a result of the cue change variable. This seemed to stem from the fact that approach-avoidance responses tended not to extinguish during testing. 3) Within the deprived groups there was a tendency for amount of cue change to be directly related to the degree of learning although the trend was not highly significant statistically. 4) When avoiding Ss were discarded from the analysis, and non-avoiding satiated and deprived Ss were combined by condition, a direct relationship between degree of learning and amount of cue change was obtained to a statistically significant degree. 5) Satiated groups contained more avoiders and a higher level of avoidance than deprived groups. Further, there was a definite relationship between amount of avoidance and amount of defecation. 6) There were no differences among groups with regard to total amount of gross bodily activity evidenced during the delay periods. 7) Deprived Ss and Ss in the large cue change condition spent more time nearer the guillotine door during the ninety-second delay period than did other Ss. 8) After the asymptote of learning had been reached, satiated Ss in the minimal-change condition and deprived Ss in the large-change condition were interchanged. On the following post-test trials the former group showed further acquisition while the latter group underwent extinction-like effects.

The results would appear to support the hypothesis that cue change, apart from any primary or secondary reward, can serve as a reinforcer for behavior. That a large cue change is a more effective reinforcer than a small one is predicted by Guthrie's contiguity position. The major effect of deprivation seemed to be that of reducing tendencies to avoid, thereby allowing approach responses to predominate.

Microfilm $2.00; Xerox $5.60. 113 pages.

THE ETHICS OF ANDERS NYGREN

(L. C. Card No. Mic 59-1839)

James Wenman Bell, Ph.D.
University of Southern California, 1959

Chairman: Professor Donald H. Rhoades

This study of the ethics of Anders Nygren deals with the fourfold concern of the eminent Swedish theologian: (1) to relate Christian ethics to philosophical ethics, (2) to explain the nature and dynamics of Christian ethics, (3) to actualize Christian ethics in the social constellation, and (4) to stimulate the Church to assume a responsible role in society. A study of the materials in chronological order reveals a noticeable movement from emphasis on the intellectual and abstract to emphasis on the practical and concrete.

In his first major work in the field of ethics, Filosofisk och kristen etik, Nygren seeks to relate philosophical ethics to Christian ethics in terms of a complementary theory which provides for a methodological division of labor, critical ethics supplying the formal category (fellowship) and Christian ethics providing the content (Agape).

In another book, Etiska grundfrågor, Nygren further defines his ethical position. The independence of the ethical judgment is crucial for the autonomy of ethics. This autonomy is constantly being threatened by eudaemonistic influences; but their association with ethics is arbitrary and has been decisively broken twice in the course of history, once by Christianity over against Judaism and once by the Reformation over against Catholicism, Evangelical ethics differs from Catholic ethics in two fundamental respects. (1) When dealing with the idea of the good, Catholicism at its best (in Augustine and Aquinas) has made relative evaluations of the good in terms of utility and pleasure, whereas Evangelical Christianity (notably in Luther) has made an absolute evaluation: the good for its own sake. (2) When considering religion as motivation for ethical living, Catholicism has thought of motivation in teleological terms: Salvation is the goal and ethical deeds are the means to that end. Evangelical Christianity has thought of motivation in causal terms. Salvation is the presupposition and ethical deeds are the result.

Nygren praises Kant for his critical line of thought—the approach afforded to ethics by the method of the a priori category. But he sharply criticizes Kant for his failure to develop the implications of his method and deduce the ethical category—for his deviation from critical to normative ethics, in which duty emerges as the content rather than the pure form of the ethical category.

The author concludes Etiska grundfrågor with a positive presentation of the ethical uniqueness of Christianity. Its ideal is unique: Agape delivers man from the double isolation of the moment and the self. Its realization is also unique: The grace of God uproots egocentricity and thus removes the ground of ethical unproductivity.

The threat of Nazism and the idealogical implications of the Second World War led Nygren to assert the relevance of Christian ethics to concrete social problems. Noting the widespread confusion as to ethical ideals, he calls for a clarification of the nature of Christian ethics: its rootage in fellowship with God, its theocratic character, its quality of spontaneous unmotivated love. He deplores the popular dichotomy into individual ethics and social ethics; he pleads for an inclusive ethics which is both and, as such, replaces aloofness with "alongsidedness." Christian love must be actualized in the social constellation, not as a Christian social program or "Christian social order," but through a proclamation of the Gospel which issues in real action.

In a recent paper delivered before the World Lutheran Council on Social Responsibility, Nygren has stressed the role of the Church. He develops the concept of the Diakonia as a theology of serving, which is central, not peripheral, in the New Testament. The Church must be concerned about the welfare of the whole man and seek to minister to all his needs.

Microfilm $2.75; Xerox $9.40. 209 pages.

KINGDOM, CHURCH, AND BAPTISM: THE SIGNIFICANCE OF THE DOCTRINE OF THE CHURCH IN THE THEOLOGY OF JOHN CALVIN

(L. C. Card No. Mic 59-2608)

John Ernest Burkhart, Ph.D.
University of Southern California, 1959

Chairman: Professor Donald H. Rhoades

This study attempts to exhibit the doctrinal relevance of certain ideas in the theology of Calvin. It is based primarily upon the 1559 Institutio, with attention given to the earlier editions, as well as to the rest of Calvin's writings.

The study rests upon three methodological presuppositions. First, Calvin's theology is an integral and comprehensive attempt to articulate Biblical theology. Second, there are certain theological motifs which are central in Calvin's thought. Third, Calvin's own writings offer a better clue to his thought than is offered by the vast volume of secondary material about Calvin. Based upon these presuppositions, and related to present theological concerns, the study is divided into three parts.

The first part is devoted to the theological context of the doctrine of the Church, since the discussion of the Church in Calvin's Institutio both follows and emerges from the rest of his thought. After an examination of the criteria, functions, and character of theology in Calvin's view, there is a discussion of his doctrine of the kingdom of God—seen under the three motifs of election, covenant,

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and fulfillment. These motifs are shown to be Christocentric, interrelated, and central in Calvin's thought.

The second part is devoted to the doctrine of the Church. The Church is integral to, derivative from, and Christocentric in, the theology of Calvin. In 1536, against Rome, Calvin sees the Church under the motif of election as the elect remnant. In 1539, against the Anabaptists, Calvin sees the Church under the motif of covenant as the covenant community. In 1543, against both, Calvin sees the Church under the motif of fulfillment as the society of Christ. All three motifs are integral to Calvin's final view. Correlative to these motifs, the marks of the Church are, respectively, the Word, baptism, and the Lord's Supper—as these bear fruit in faith, community, and nurture, respectively. The Church is God's chosen means by which He invites us into the fellowship of Christ and retains us in it. The Church is one, holy, catholic, and apostolic—outside of which there is no salvation.

The third part is devoted to baptism as the sign and seal of initiation into the Church. After a discussion of Calvin's doctrine of the sacraments and of baptism, the focus is upon his defense of paedobaptism. It is shown that his doctrine of the sacraments and of baptism is so related to the correlation of election and faith that faith must be presupposed in the recipient. Under the motif of election, paedobaptism is defended in 1536 on the basis of the possibility of infant-knowledge. However, without sufficiently revising his doctrine of the sacraments, Calvin offers his defense of paedobaptism in 1539 under the motif of the covenant. The continuance of this defense through 1559 indicates that paedobaptism within the covenant is to be justified on the basis of the propriety of the covenant motif in the doctrine of the kingdom and of the Church. Calvin's defense of paedobaptism rests upon the status of the children of believers in the Church, and itself exhibits the nature and extent of God's grace in and for the Church.

The conclusion implicit in the study is that Calvin's stress upon election, covenant, and fulfillment, as these motifs are integrated in his thought, results in a doctrine of the Church which avoids both sectarianism and latitudinarianism—by holding the concerns for faith, community, and nurture in vital tension.

Microfilm $3.45; Xerox $11.80. 268 pages.

SOCIAL PSYCHOLOGY

ETHNIC INTER-GROUP DIFFERENCES IN PERSONALITY, GENERAL CULTURE, ACADEMIC ABILITY, AND INTERESTS IN A GEOGRAPHICALLY RESTRICTED AREA

(L. C. Card No. Mic 59-2543)

Harold Miller Bitner, Ph.D.
The Ohio State University, 1954

The present study is an investigation of ethnic differences in the Hawaiian Islands as they are manifested by performance on paper and pencil tests of academic ability, personality pattern, interests, and general culture administered to members of the entering Freshmen class at the University of Hawaii in September, 1948. The population of the Hawaiian Islands consists of a heterogenous mixture of many different races, including Hawaiian, Chinese, Japanese, Koreans, Filipinos, Puerto Ricans, Portuguese, and Caucasians. As in any comparatively small geographical area where many different peoples have lived in proximity for a number of years, a considerable amount of intermarriage has taken place with the result that any consideration of ethnic groups in the Islands should include racial mixtures. Other things being equal, the longer two or more given national groups have been in the Islands, the greater the likelihood that intermarriage shall have taken place. Historically, excluding the Caucasians and the Original Hawaiians, the first large racial group to come to the Islands was the Chinese. The Chinese, who arrived about 1860, were followed by the Japanese in 1900, the Portuguese and Puerto Ricans in about 1910, and the Filipinos from that time until the Philippine Islands became an independent nation.

The present study has included as many different aspects as possible of the racial situation as it actually exists in the Islands and in so far as the freshmen class of 1948 at the University of Hawaii is representative of the larger Island-wide situation.

The study is an attempt to examine ethnic differences among entering college students on the variables of general culture, interests, academic ability, and personality. The study has several advantages. In the first place, the subjects are of approximately equal academic status: they are all products of Hawaiian secondary schools and have been accepted as entering freshman at the University of Hawaii. Under these circumstances, none should be markedly handicapped by test mechanics inability to read test content. All are of approximately equal age, and they have lived in the same comparatively homogeneous and small geographical section.

In reality the study is a comparative examination of test performance of the ethnic elements of the University of Hawaii freshmen class. The study does not attempt to compare ethnic groups per se, but only the performance of a selected sample of ethnic groups on a series of tests, with the further assumption that the subjects included were of approximately equal academic standing and age.

The sample used consists of Territory of Hawaii high school graduates who entered the University of Hawaii as beginning freshmen in the fall of 1948. Of the 1,281 persons who entered the University of Hawaii that fall, 852 came from the 36 secondary schools of the Territory of Hawaii, 114 were graduates of mainland United States high schools, 42 were graduates of foreign secondary schools, and 273 were veterans who received high school credit by means of General Educational Development Tests. For the purposes of the present study only graduates of the Territory of Hawaii secondary schools are considered.

The American Council on Education Psychological Examination, 1946 Edition, the Ohio State Psychological Examination Form 23, and the Coöperative General Culture Test Form S were administered to each prospective student during the spring and summer of 1948. That fall, during their first semester, the Kuder Preference Record, Guilford-Martin Personnel Inventory, Guilford-Martin Inventory of Factors STDCR, and Guilford-Martin Inventory of Factors GAMIN (abridged edition) were administered to the freshman class.

The American Council on Education Psychological Examination and the Ohio Psychological Examination were used to secure a measure of academic ability. The Guilford-Martin Inventories were used to secure a measure of personality. The Kuder Preference Record was used to measure interest, and the Coöperative General Culture Test was used as a means of measuring general culture.

Since the Guilford-Martin Inventories and the Kuder Preference Record were administered in the beginning English classes during the first semester, absences from classes made it impossible to secure these measures on every student. Every student, however, had equal opportunity with every other student to appear in the study.

Actual plans called for the inclusion of nine ethnic groups represented among the students at the University of Hawaii. These groups were: Chinese, Japanese, Caucasians, mixed Orientals, mixed Caucasians, Koreans, Hawaiians, Filipinos, and Portuguese. These were not sufficient numbers of students of the Hawaiian, Filipino, and Portuguese groups to warrant their inclusion in the study. As a consequence these groups were dropped from consideration.

For purposes of the study males were compared together and females compared together for each of the ethnic groups. The final sample consisted of 101 Chinese, 58 males and 43 females; 409 Japanese, 226 males and 183 females; 52 Caucasians, 30 males and 22 females; 17 mixed Caucasians, 8 males and 9 females; 40 mixed Orientals, 22 males and 18 females; and 15 Koreans, 10 males and 5 females.

Summary and Conclusions

The hypothesis tested was that in a cultural milieu where there are many ethnic groups in a confined and limited geographical area, significant intergroup differences exist in academic ability, personality, interest, and general culture. The method of statistical analysis used in determining the significance of differences found was analysis of variance.

The principal findings of the study are as follows:

1. When academic ability was considered, significant differences were found in favor of the Caucasians over all other ethnic groups. The Chinese were superior to the remaining ethnic groups considered in the study.

2. When interests were considered among males of the ethnic groups, few significant differences were found. The Caucasians and mixed Orientals were rated higher than the Japanese in persuasive interests. In regard to literary interests (male) the Caucasians rated higher than the mixed Orientals and the Japanese rated higher than the Chinese. For social service (male) the Japanese scored higher than the Caucasians.

3. No significant differences were found among the females of the ethnic groups in the mechanical, scientific, persuasive, literary, musical, and clerical sections. In computational interests the Japanese rated higher than the Koreans. In artistic interests the mixed Caucasians were rated higher than the Japanese. In social service interests mixed Orientals were scored higher than Chinese and Caucasians; Japanese were scored higher than Caucasians, and Koreans were scored higher than Chinese and Caucasians.

4. In the field of personality, as measured by the Guilford-Martin Inventories, the picture of adjustment among the Island female groups studied did not differ materially from mainland norms in that means for all groups were found within the "normal" range. However, certain significant inter-ethnic differences did appear. Mixed Caucasians showed significantly better social introversion-extroversion scores than did Japanese, Chinese, Caucasians, and Koreans. They also showed a greater tendency toward vigorous overt action than did all of the rest of the groups studied. The mixed Caucasians also showed a significantly higher tendency toward social leadership and lack of passivity than did Japanese or Caucasians. Chinese were significantly more objective than were Caucasians, while Caucasians revealed a tendency toward less depression and toward greater cheerfulness than did the Japanese. The Caucasians were also significantly more rhathymic (impulsive, carefree, happy-go-lucky) than were the Japanese. Mixed Orientals were significantly less rhathymic than were the Chinese, Japanese, or mixed Caucasians. No significant differences were found among any of the ethnic groups studied in coöperativeness, agreeableness, masculinity-femininity, nervousness, stability of emotional reactions, thinking introversion-extroversion, or feelings of inferiority.

In the area of personality among males no marked differences were found when the status of the groups studied was compared with mainland norms. Means for all groups were found within the "normal" range for mainland norms, with the exception of general activity which was slightly lower for the Island group. Certain significant inter-ethnic differences did appear, and there were a greater number of such differences than there were among the female groups studied. When compared with both Chinese and Japanese, Caucasians were significantly more sociable and displayed more social leadership, but were less happy-go-lucky and impulsive. The Caucasians tended to be more coöperative and to have less feelings of inferiority than the Chinese, and displayed more of a tendency toward masculinity than did the Japanese. The Japanese tended to be more agreeable, as did the Koreans, than were the Caucasians. A generally low normative picture in general activity obtained for all groups except the Caucasians and mixed Caucasians, both of whom were significantly more active than the Chinese or Japanese. The mixed Orientals also displayed a greater tendency toward overt activity than did the Japanese. The Chinese were more sociable and displayed more social leadership than did the Japanese. Mixed Orientals were more social, displayed more leadership, and were more rhathymic than the Chinese, Japanese, or Koreans. They also displayed less feelings of inferiority than the Chinese or Japanese. Mixed Caucasians were more rhathymic and displayed a greater tendency toward social leadership than did the Japanese. Mixed Orientals also tended to display a greater tendency toward masculinity than did the Japanese. No differences among any of the ethnic groups included in the study were found in

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thinking introversion-extroversion, tendency toward depression, emotional instability, nervousness, or objectivity.

5. In general culture, current social problems (male) the Caucasians were superior to the Japanese, Chinese, and mixed Orientals. No significant differences were found among the females of the different ethnic groups. In history and social science (male) the Caucasians were superior to the Chinese and Japanese. The Japanese were superior to the mixed Orientals. No significant differences were found among the females. In literature (males) the Caucasians were superior to the Japanese and Koreans. Among the females the Caucasians were superior to the mixed Caucasians, Chinese, and Japanese. The Koreans were superior to the Chinese and mixed Orientals. In sciences (males) the Caucasians were superior to the Japanese and mixed Orientals. No significant differences were found among the females. In fine arts (males) the Caucasians were superior to the Japanese and mixed Orientals. The Chinese were superior to the Japanese. No significant differences were found among the females. In mathematics (male) the Caucasians were superior to the mixed Orientals, Koreans, and Japanese. The Chinese were superior to the mixed Orientals and Koreans, and the Japanese were superior to the Koreans. Among the females the Caucasians were superior to the mixed Orientals.

The Caucasians tended to score higher on the General Culture Test than all other ethnic groups studied. There were more and greater differences among the males than were found among the females in the area of general culture, as measured by the Cooperative General Culture Test.

While results of this study indicate that differences do exist between the ethnic groups studied, frequently differences within the groups were found to be larger than intragroup differences. Evidence also seems to indicate that college freshmen in the University of Hawaii compare faforably with mainland United States college freshmen in all areas measured.

Microfilm $2.00; Xerox $6.40. 135 pages.

Abstract published by special arrangement with the Ohio State University.

THE EFFECTS OF MANIFEST ANXIETY, STRESS AND STIMULUS AMBIGUITY ON YIELDING BEHAVIOR

(L. C. Card No. Mic 59-2660)

Landon Burns Cox, Ph.D.
Syracuse University, 1959

The purpose of the present study was to investigate the effects of manifest anxiety, stress, stimulus ambiguity, and the interactions between these on susceptibility to informational social influence. The hypotheses were derived from that part of behavior theory dealing specifically with drive variables and response competition.

Anxiety was operationally defined as the score obtained by each S from a scale designed to measure motivational level. Stress was induced by threat of electric shock for unsatisfactory performance. Stimulus ambiguity was determined by subtracting the percentage of yielding responses on individual items by groups responding under private conditions from the percentage of yielding responses on individual items by a group responding under social influence conditions. Informational social influence was defined as the frequency with which S gave a response that was in agreement with the expressed consensus of the group when no effort had been made to motivate him to agree with the group, per se.

The apparatus for determining the influence of social pressure was a panel of lights and switches. The experimental situation was a contrived one that required the S to select the correct response in the presence of what appeared to be a unanimously incorrect judgment on the part of other members of the group. The judgments called for were of a perceptual, informational, or attitudinal nature.

Dispositional tendencies to conformity were determined by administering a scale designed to measure ideology of conformity, and a check list composed of self-descriptive adjectives.

The control groups were used in the procedure for determining stimulus ambiguity which preceded the experiment proper. Thirty Ss responded privately. An additional 25 Ss were used to check the results of this group. They too responded privately. A third group consisted of 50 Ss who responded under social influence conditions.

The experimental Ss used in the present study consisted of a group composed of 20 high-anxious Ss tested under conditions of stress; a group composed of 20 high-anxious Ss tested under conditions of non-stress; a group composed of 20 low-anxious Ss tested under conditions of stress; and, a group composed of 20 low-anxious Ss tested under conditions of non-stress.

The evidence was not conclusive, but there were indications that basic personality differences existed between yielding and independent Ss. These differences appeared particularly in the area of interpersonal relationships and dispositional tendencies to conformity.

Total yielding scores based on all critical items failed to differentiate between high and low-anxious Ss, or between stress and non-stress variations. The same results were found for informational and attitudinal items analyzed separately. However, when scores for perceptual items alone were analyzed, significant differences were found between high and low-anxious Ss. No significant differences were found for stress variations throughout the study.

The temporal effects of anxiety and stress on yielding behavior were determined by analyzing first- and second-half scores on perceptual tasks. No difference was found between experimental groups on first-half scores. However, significant differences were found in second-half scores for anxiety levels.

An analysis of the data relevant to performance at the various levels of ambiguity indicated that there was a significant increase in the frequency of yielding responses as stimulus ambiguity increased.

On the basis of the present study it was concluded that behavior theory might be used to suggest fruitful hypotheses concerning social psychological relationships.

Microfilm $2.00; Xerox $6.80. 143 pages.

THE PSYCHOLOGY OF PERSONAL CONSTRUCTS AS RELATED TO GROUP MEMBERSHIP AND LEADERSHIP

(L. C. Card No. Mic 59-2552)

Richard Baldwin Cravens, Ph.D.
The Ohio State University, 1954

The study tested four hypotheses having to do with group behavior. A group of twenty-nine fraternity members were randomly selected from a large social fraternity at The Ohio State University. The subjects met as a group in two experimental sessions. In the first session, the subjects were given a REP Test which is designed to elicit personal constructs. In addition to the REP Test, two tests were administered to measure popularity and initiative. These tests were called targets.

In the second experimental session, the subjects took a modified REP Test. Instead of producing their own constructs, the subjects were supplied with a list containing representative group constructs. This list was compiled from the first REP Test. The modified REP Test presented the task of using the group constructs to indicate the likenesses and differences of the subject's fellow members.

Each subject had a series of scores. The construct score was a value assigned which indicated the degree each subject used the representative constructs of the group. The popularity score indicated the degree to which each member wanted to be with every other member in a social situation. The initiative score indicated the degree to which a subject assumed house duties, participated on committees, etc.

Hypothesis A

Members of a group whose constructs are most frequently used by other members of the group will, in turn, have higher target ratings.

Correlations and a test of chi square failed to reveal a significant relationship between construct score and target scores.

Hypothesis B

Those group members who are able to construe an "ideal fraternity type" will, in turn, have higher target ratings.

When tested with chi square, there were no significant differences between target scores and a value based on a factor analysis of the modified REP Test.

The results obtained for hypotheses A and B are considered to be too ambiguous to support them. Therefore, they could not be accepted or rejected. The conclusion is that a different approach to the problem may be profitable. Such an approach would depart from the concretistic use of the constructs and would move more in the direction of an abstract interpretation of constructs.

Hypothesis C

The group president will be perceived as more closely resembling the "ideal fraternity type" than he will be perceived as resembling the average group member.

This hypothesis was accepted at a high level of confidence.

Hypothesis D

The group president will be perceived as more closely resembling the "ideal fraternity type" than will the average group member.

It was possible to accept this hypothesis at a high level of confidence.

The highly selective features of the sample undoubtedly places severe restrictions on the range of generalization for hypotheses C and D. It has been pointed out, however, that the hypotheses were accepted at a high level of confidence. Furthermore, two independent theories made the same predictions. We, therefore, believe that the generalizations are not as limited as might be assumed on the basis of the sample.

Microfilm $2.00; Xerox $5.20. 97 pages.

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DIMENSIONS OF MISPERCEPTION IN INTERPERSONAL RELATIONS

(L. C. Card No. Mic 59-2843)

Sylvia B. Gilliam, Ph.D.
Columbia University, 1959

Very few correlates of sociometric misperception can be found using what Cronbach has described as "global" scores because there are various dimensions of sociometric misperception. We have identified five dimensions. Correlates positively associated with one dimension of misperception may be negatively associated with another dimension. An important part of sociometric misperception is ascribable to a group directional patterning based on the values of the group as reflected in sociometric status. This source of misperception has not heretofore been considered but its presence masks the relationship of correlates with other types of misperception. From the standpoint of its proportions, persistence, and basis in group functioning, it cannot be ignored; it is the sociological aspect of sociometric misperception. Another dimension of misperception is the individual self-ranking errors, presumably based on personality mainly, and perhaps also on mood or situational factors. A third dimension is the general impression created about one's emotional expansiveness by the perceived person. The last two are the acuity of the perceiver and the "openness" or discriminability of the perceived.

The subtraction one from the other of two equations from the analysis of variance produces a third equation whose terms uniquely render the dimensions postulated with the exception that the residual cannot easily be broken down into that ascribable to lack of discrimination, and to the lack of "openness" respectively.

There are, however, other influences on misperception not amenable to the indices derived from the variance equation. These are those attributes of the relation itself that cannot be predicated on the individuals involved in the relation. One of the most important of these is the contact that characterizes the relation and which is a necessary condition to its development, especially because it helps us to trace the developmental process of sociometric misperception. Other relational attributes that we examined were the strength of the feeling perceived, and the degree of

congruence between feeling and reciprocal perception which greatly affects the clarity of the impression created by the object person.

We have attempted at all points to integrate the sociological with psychological concepts, without which we believe it is not possible to elucidate sociometric misperception. We have introduced such sociological concepts into the analysis as: status, group structure, values, degree of conformity to norms and values, contact, interaction, intimacy, a relation and its attributes. These have been used with such psychological concepts as: intelligence, acuity, shyness, interest, self-image, motivation.

Microfilm $3.40; Xerox $11.60. 264 pages.

CERTAIN FACTORS RELATED TO PARENTAL VOCATIONAL AND EDUCATIONAL ASPIRATIONS FOR BOYS

(L. C. Card No. Mic 59-2849)

Martha Bennett Heyde, Ph.D.
Columbia University, 1959

The purpose of this investigation was to inquire into some of the correlates and possible determinants of level of parental vocational and educational aspiration for boys.

That it is important to study parental vocational and educational aspirations for children is indicated by research findings that such aspirations tend to influence young people's aspirations for themselves. These, in turn, affect the vocational and educational choices of young people, and ultimately their way of life. Although much is known about correlates and possible determinants of the vocational and educational aspirations of young people for themselves, there is a paucity of corresponding information about parental aspirations for children. It is here theorized that at least some of these correlates and possible determinants are the same as or similar to those of children's aspirations for themselves. In this study the relationship between level of parental vocational and educational aspiration for boys and some of the possible determinants of such aspirations was investigated.

The hypothesis was tested that level of parental vocational and educational aspirations for boys is a function of the socioeconomic status and occupational mobility of the family, parental educational level, and parental perceptions of the boys' academic achievement and ability levels and attitude toward school. Aspiration level was hypothesized to be (1) positively related to socioeconomic status and educational level, (2) higher in upwardly mobile families than in families of stable mobility and higher in those of stable mobility than for the downwardly mobile, (3) positively related to perceived achievement and ability levels, and (4) positively related to perceived degree of liking for school.

The subjects of this investigation were parents or parent-substitutes of 134 of the 142 ninth grade boys of the Career Pattern Study, a twenty-year longitudinal study of vocational development.

Semi-structured recorded interviews had been held with these parents by Career Pattern Study staff. Transcriptions of the interviews were analyzed and rated (inter-judge agreement in analysis and rating being determined) for all variables referred to in the hypothesis except socioeconomic status and occupational mobility of family. The socioeconomic status ratings, made by the Career Pattern Study staff, and the occupational mobility ratings, made by this investigator and her co-raters, came from a variety of sources in addition to the parent interviews.

Certain additional variables found en passant during the interview analysis were retained for further statistical treatment. These included Restriction of Parental Vocational Aspiration for Boy and Combination of Unrestricted and Restricted Parental Vocational Aspiration for Boy (treated as aspiration variables), Financial Obstacle to Education (treated as a status variable), and Parental Attitude toward Boy's Academic Achievement and Parental Perception of Boy's Ability to Improve Academically (treated as achievement and ability variables). In addition, two variables based on data obtained from school records, Academic Achievement Level of Boy and Intelligence Level of Boy, were treated as achievement and ability variables.

The hypothesis was then tested by chi square analyses. Sometimes in testing the relationship between two variables, a third variable related to the other two, and possibly antecedent to them, was held constant.

Of the hypothesized relationships, significant relationships were found between level of parental vocational aspiration for boys and occupational mobility, and between level of parental educational aspiration for boys and parental occupational level.

Of the non-hypothesized relationships, significant relationships were found between level of parental vocational and educational aspirations for boys and boys' intelligence and academic achievement levels and between combination of unrestricted and restricted parental vocational aspiration and socioeconomic status.

Implications were adduced for theory, future research, and practice. Microfilm $2.40; Xerox $8.40. 182 pages.

THE MEASUREMENT OF ACCURACY OF SELF-ROLE PERCEPTION

(Publication No. 24,132)

John Ernest Sidney de Jung, Ed.D.
Syracuse University, 1957

In approaching the problem of the measurement of accuracy of self perception, consideration has been operationally limited to a social emphasis of self perception which may be defined in terms of awareness of self as seen and described by others, the recognition of one's social reflections, the cognizance of the evaluative interpretations which others give to one's behavior or presence. An unidimensional approach has been adapted, involving self perception in terms of a given singular social role, the given role operationally defined by a description of a social need situation.

The offered measure of accuracy of self role perception is described as a perceptual extension of the Syracuse Scales of Social Relations and Group Structure. This parent instrument affords a measure of a subject's perception of the need-satisfaction potential of each of his group members with respect to a given social need.

The perceptual extension of the Syracuse Scale involves the added subject task of estimating the rating received

from each member of his group. This task immediately follows the regular Syracuse Scales administration and permits a measure of the accuracy of each member's awarenesses of how other group members rate him. Each rating received is subtracted from each corresponding estimate made and these guess discrepancies, or Dg scores, are averaged for each person; this average defining that person's accuracy of self role perception. The average may be based on either algebraic or absolute Dg scores; both measures are meaningful, though the latter is to be endorsed for group comparisons.

The reliabilities of the Dg scores were obtained for need-affiliation in a college fraternity sample of 12 members and for need-succorance in a public school sixth grade class of 22 pupils. The fraternity group was tested twice on the same evening and the average product moment correlation coefficient for the test-retest individual Dg scores for the 12 members was .82. Forty-four percent of the 121 Dg scores were identical for the two situations; 46 percent of them differed only one scale unit. In terms of the mean algebraic Dg scores, the retest reliability coefficient was .84.

The public school sixth graders were tested twice with an intervening two-week period. The average product moment coefficient for the test-retest individual Dg scores, based on six randomly chosen pupils, was .42 for the algebraic Dg scores and .37 for the absolute Dg scores. Thirty-four percent of the 126 absolute Dg scores, made by the six randomly chosen sixth graders, remained identical over the two-week period, 35 percent of them differed only one scale unit. In terms of the mean absolute Dg scores, the retest reliability coefficient was .66. It may be logically argued that a group mean Dg score would exhibit still greater stability.

The entire attending pupil population of grades five through twelve (N = 387) in a central school was tested in a single day in a cross-sectional study of the accuracy index. Group means based on the pupils' mean absolute Dg scores for the grade as a whole and for boys and girls separately were examined. A significant (non-linear) trend of decreasing mean absolute Dg scores (increased accuracy) with increased grade was found. This trend was reversed after the eleventh grade for both sexes.

No overall sex differences in accuracy were found. Both sexes were found to be more accurate in perceiving ratings made of them by opposite sex members than by same sex members, though girls were less consistent in this respect than boys. The opposite sex-same sex differences were significant at the seventh, eighth, ninth, and eleventh grades.

In terms of product moment correlation coefficients, no relationship was found between mental age as measured by the California Mental Maturity Tests and the mean absolute Dg score at any grade level. The largest of these coefficients was a -.18 at both the tenth and eleventh grade levels.

Microfilm $2.35; Xerox $8.20. 178 pages. Mic 59-3163.

VOLITIONAL CONFIRMATION; INDIVIDUAL DIFFERENCES AND RELATIONSHIPS TO THE ZEIGARNIK EFFECT

(L. C. Card No. Mic 59-2700)

Robert Vincent Katter, Ph.D.
University of Oregon, 1959

Adviser: Richard A. Littman

Volitional Confirmation is the recognition or belief on the part of an organism that it has a degree of instrumental control over the antecedents of those rewards and punishments which are relevant to its currently operating motives. It is argued that the event of volitional confirmation may be identified theoretically as the prime satisfier of such motives as the need for power, need for completeness, for self-actualization and for cognitive clarity.

The main hypothesis of this study was that there would be a positive relationship between an individual's degree of differential preference for tasks with more volitional confirmation, and his sensitivity to the conventional Zeigarnik measurement.

The Zeigarnik procedures were administered first, with the volitional confirmation procedures second. Both were explained as devices which were being used to screen candidates for inclusion in still another part of the experiment. For the Zeigarnik procedure, a specially refined booklet of clerical tasks was group-administered to the subjects. One-third of the tasks scattered through the sequence were set so that they could not be completed in the seventy-five seconds allotted to each task. After an eight minute interposed distraction period, task recall was tested. The procedure provided the following variables: number of tasks completed, conventional Zeigarnik Difference, proportions of completed, incompleted, and total recalls, and two measures of the completion-primacy effect, -- the extent to which completed recalls dominate early in comparison to late portions of the sequence of recall.

The volitional confirmation procedure consisted of playing an "A-game" to criterion followed immediately by a "B-game," and concluded with the administration of a rating form which secured the subject's reactions to the two games. The A-game was a concept formation task consisting of a series of three-by-three matrices of letters. In a random half of the matrices was embedded a particular combination of letters, the subject's task being to discover this combination. On each trial the subject indicated whether he thought the combination was present, after which he was told whether he was correct. The A-game was terminated after eight correct responses in a row.

The B-game which followed was superficially the same as the A-game, but the subject was told that the "principle of its combination" was different. Actually, the B-game matrices contained only random letters and no consistent combination whatever. Independent of his responses to the B-game, the subject was told that he was correct for those trials which corresponded to A-game trials on which he had actually been correct. Thus the number and pattern of successes was identical in both games.

In the rating of the games, almost all subjects rated the B-game as more difficult. Of this group, 83 chose to play the A-game in a supposed subsequent session, and

33 chose to play the B-game, the latter displaying what we call a "counteractive preference."

The main hypothesis of this study was not confirmed. Substantial relationships between volitional confirmation and Zeigarnik variables were found only for individuals showing the counteractive preference. As the strength of counteractive preference increases, there are decreases in the score on a number of Zeigarnik variables. The number of tasks completed, proportions of completed, incompleted, and overall recalls, as well as the completion primacy measures and certainty about personal capabilities to play either game, all show this pattern.

The results are discussed and related to "Weak Ego" patterns, "unrealistic" aspirational patterns, and "vigilant" recognition patterns from other researches.

Microfilm $2.00; Xerox $4.60. 89 pages.

A COMPARATIVE STUDY OF ROTC AND NON-ROTC FRESHMEN IN A LIBERAL ARTS COLLEGE WITH RESPECT TO CERTAIN ATTITUDINAL AND PERSONALITY VARIABLES

(L. C. Card No. Mic 59-2084)

Irving Krongelb, Ph.D.
New York University, 1959

This study was concerned with the comparison of two groups of freshmen who entered Brooklyn College, in New York City, in September 1956 and February 1957. The population included (1) all the freshmen in these classes who elected to enroll in the AFROTC and (2) a matched group of their classmates who did not enroll in the AFROTC. The two groups were matched on the basis of age, class in college, non-veteran status, and intelligence and scholastic aptitude.

The variables selected for investigation were:

1. Attitudes and opinions concerning military service, as measured by the Military Service Opinionnaire, an instrument developed by this investigator specifically for this study.

2. Several dimensions of the self-concept, as measured by the Index of Adjustment and Values (Bills).

3. Authoritarianism, as measured by the Social Opinion Inventory (The California F-scale).

It was hypothesized that significant differences would be found, in these variables, between the two groups of students.

The various measures were administered both individually and in groups, and care was taken to preserve the anonymity of the respondents in an effort to ensure frankness in their responses.

Findings

The findings may be summarized as follows:

1. The students in the AFROTC were significantly more favorable toward military service than those not in the AFROTC.

2. Self-descriptions, ideal-self descriptions, and self-acceptance were very similar in both groups.

3. The students in the AFROTC came much closer to their concept of the "commissioned officer" than did their non-AFROTC classmates, both in their current-self descriptions and in their ideal-self descriptions.

4. The non-AFROTC group scored higher in authoritarianism than did the AFROTC group, but the difference was not statistically significant. Both groups were relatively low in authoritarianism.

5. Both groups of students appeared strongly motivated by educational and career plans.

6. A slight, but statistically significant, positive relationship was found between authoritarianism and attitudes toward military service.

7. Examination of the relationship between authoritarianism and self-concept failed to reveal any marked differences among the subjects when they were divided into "high authoritarian" and "low authoritarian" subgroups.

Conclusions

As a group, the subjects appear to be very homogeneous with respect to the variables studied. They are neither especially favorable nor especially unfavorable toward military service, and in their self-descriptions they reflect a sensitivity to the demands of social living. The level of authoritarianism in the group is relatively low.

Such differences as do appear between the AFROTC and non-AFROTC groups are directly related to their thinking concerning the military service situation. It is clear that they are concerned about the service and the effect it will have upon their educational and career plans. It is equally apparent that certain major decisions concerning military service are being made by these young men before they enter college, and these decisions seem to be directly related to experiential and personality factors. Most of the students in this population who have enrolled in the AFROTC have done so as part of their long-range career planning; very few have done so in an effort to avoid being drafted.

The pattern reflected by these subjects is considered applicable to college freshmen in general.

Implications

The findings of this investigation would appear to have a direct bearing on the AFROTC recruitment effort. Students such as those here studied, who are not especially unfavorable toward military service, who are low in authoritarianism, and who are strongly career-oriented, are actually the type of student in whom the Air Force is interested. The distribution of scores in the various measures used in this study indicates that there are probably more potential officers among the entering freshmen in our colleges than have acutually enrolled in the AFROTC program; the Air Force would perhaps wish to consider means of attracting these students.

Microfilm $2.00; Xerox $7.00. 149 pages.

THE USE OF ROLE PLAYING AS A METHOD FOR PRODUCING SELF-PERCEIVED PERSONALITY CHANGE

(L. C. Card No. Mic 59-2857)

Barry Livingston Levin, Ph.D.
Columbia University, 1959

The present study was designed to investigate the effect of role playing on certain aspects of personality. A number of hypotheses was formulated to test some of the claims made for the effectiveness of role playing as a means of producing personality change. These hypotheses state that variance scores on the variables of order, aggression, and dominance decrease for subjects participating in role playing; they state, also, that subjects who participate in role playing increase in affiliation, nurturance, intraception, and exhibition, and decrease in abasement, succorance, and deference.

In order to test these hypotheses, a sample of 96 subjects was drawn from a course, Education and Personality, offered at Teachers College, Columbia University, during the June 1956 Inter-Session. The subjects were divided by means of stratified random sampling into 12 small groups which met four times a week for one-hour sessions over a three-week period. Six of the groups were engaged in role playing. Three of the groups were formed into study groups which controlled for task orientation. The remaining three groups were formed into discussion groups which controlled for group member interaction. In addition, members of a class in Introduction to Measurement at Teachers College, Columbia University, were used as subjects to control for the effect of the lectures, which members of the course, Education and Personality, were required to attend in addition to their small group activity.

The Edwards Personal Preference Schedule (EPPS), which provides measures of the variables considered in the hypotheses, was administered at the beginning and at the end of the experiment. The Self-Rating Personality Scale (SRPS) was administered, also, to obtain supplementary data.

The analysis of the data supported the following conclusions:

1. The hypotheses of this study were not confirmed by the data.
2. In addition, analysis of supplementary data did not support the claims for specific kinds of personality change said to be associated with role playing.

Recommendations were made for further research.

Microfilm $2.00; Xerox $4.40. 85 pages.

IMMEDIATE AND DELAYED EFFECTS OF SOCIAL INFLUENCE UPON INDIVIDUAL OPINION

(L. C. Card No. Mic 59-2595)

Paul Richard Robbins, Ph.D.
Columbia University, 1959

The study was designed to explore both the immediate and delayed effects of social pressure on individual opinion. Variables considered were the presence of a threat that the individual's opinion would be revealed to the group, the size of the majority supporting the group position, and personality needs of the subjects as measured by the Edwards Personal Preference Schedule.

Subjects were 133 students in courses in elementary educational psychology at Teachers College, Columbia University. The experimental procedure was built around the showing of a film called, The Head of the House. In a pretest, subjects were first shown this film, and then given several instruments (including a Likert-type scale) which measured their opinions about a problem raised by the film.

One week after the showing of the film, the instruments were readministered under the following experimental conditions: high majority-threat, high majority-no threat, low majority-threat, and low majority-no threat. The majority variable was introduced by communications to the groups of different bogus figures as to how the majority of students had responded the previous week, (in the high majority group, subjects were told 86% of the students had supported a particular position while in the low majority group the figure given was 56%). The threat variable was introduced by a communication to all subjects that there would be a group discussion of the problem, and that some students would be expected to read their positions to the group and defend them against criticism (half of the subjects were informed they would read and half were informed that they would not.) After the data had been collected, the discussion was postponed on a pretext.

Three weeks after the pretest, the instruments were readministered to assess the delayed effects.

The data were analyzed primarily by analysis of variance. The following results were indicated:

(1) The "majority technique" was effective in producing opinion change.

(2) In general, the degree to which subjects were immediately influenced by social pressure was the same whether: (A) the size of the majority was larger (86%) or smaller (56%), (B) the individual was or was not given the expectation that his position would be revealed to the group.

(3) Although the influence of threat did not have a general effect on immediate opinion shift, it had a significant effect on the opinions of subjects who subsequently withdrew from the research project.

(4) There was a positive relationship found between immediate influence scores and subsequent withdrawal from the research project.

(5) In spite of fluctuations in the experimental sub-groups, the over-all delayed effects were equal to the immediate effects.

(6) Delayed influence scores are similar for threat vs. no-threat and for high vs. low majority.

(7) The pattern of response from the experimental session to the posttest appeared different for the experimental treatments: both threat and high majority tend to be positively related to the drop in score from experimental session to posttest.

(8) There were no significant correlations found between measures on the Edwards Personal Preference Inventory and immediate or delayed influence scores which held for the combined experimental groups. However, there were

indications that correlations between Edwards scores and immediate influence scores differed under threat and no-threat conditions. This was particularly true for N-aggression, N-nurturance, and N-heterosexual.

Microfilm $2.00; Xerox $5.00. 96 pages.

AN EVALUATION OF A PRERETIREMENT PLANNING PROGRAM—THE TVA EXPERIENCE

(L. C. Card No. Mic 59-2958)

Roger Williams Walker, Ph.D.
Cornell University, 1959

The purpose of this study was to test the hypothesis that an individual who, prior to retirement, was exposed systematically to information regarding the problems and opportunities of retirement would take specific actions in terms of preparing for retirement and would develop a better attitude toward retirement prior to retirement than a similar person not exposed to such material.

The study, conducted within the Tennessee Valley Authority, is divided into five parts: a discussion of the nature and incidence of preretirement planning generally in American industry - Chapter I; a discussion of the development of labor relations policy in TVA - Chapter II; a tracing of the development and current dimensions of the TVA planning for retirement program - Chapter III; an evaluation of the program itself and related aspects of the TVA situation - Chapter IV through Chapter VIII; and, the conclusions and recommendations, both specific and general which flow from the body of the study - Chapter IX.

Information was gathered through both mail questionnaires and personal interviews. Questionnaires were completed by TVA employees who participated in the 1956 and 1957 sessions of the preretirement planning program. The questionnaires gathered information regarding specific preretirement actions that the participants had taken and information regarding participant opinion in the following attitudinal areas: general attitude toward retirement; personal expectations regarding retirement; attitude regarding personal job; meaning of work to the individual; personal appraisal of health at the present time; personal attitude toward retirement; and, attitude toward certain aspects of the program Personal interviews were conducted with a sample group of 1956 participants, a sample group of 1956 non-participants, TVA personnel officers, trade union leaders and the preretirement program leaders. The interviews yielded information to validate the questionnaire returns, general information supplementary to the questionnaires and information from the non-participants which was compared, on a control group basis, with similar information gathered from participants. All the persons interviewed, except the non-participants, had had considerable contact with the development and conduct of the program. In addition to information regarding the program itself and its effect, data were gathered bearing on: the effects of flexibility in a retirement system; the effects of a change in corporate retirement policy; the effectiveness of certain mechanisms designed to administer the policy.

The findings of the study can be summarized as follows: (1) the program itself is a marked success in terms both of influencing participants' critical preretirement attitudes and of motivating participants to make plans for retirement and to perform individual actions necessary to effectuating these plans; (2) leadership for a program of this nature need not be at and near retirement age themselves. Successful leadership seems to rest primarily on a combination of adequate maturity, sufficient subject matter competency and general ability as a group discussion leader; (3) the structuring of discussion groups for a program of this nature should be done with great care in terms of creating groups which possess social, economic and educational homogenity since the study shows that group heterogeneity erects severe barriers which endanger program success; (4) program literature, unless chosen with an awareness of the participants' educational background and kept to a minimum in terms of total volume, is likely to be of little if any help to program participants; (5) active trade union support and participation in retirement policy changes, the administration of retirement policy and the development of preretirement programs appear to enforce the chances of success both in the policy and program areas; and, (6) programs of this general nature can be evaluated in terms of their effectiveness in motivating employees to prepare, both substantively and psychologically, for retirement.

Microfilm $10.50; Xerox $37.40. 831 pages.

SOCIOLOGY

SOCIOLOGY, GENERAL

A COMPARATIVE STUDY OF COMMUNITY ACTION PROGRAMS

(L. C. Card No. Mic 59-2009)

Severyn Ten Haut Bruyn, Jr., Ph.D.
University of Illinois, 1959

This is the study of what happened in four Illinois communities when significant portions of the local population in each case were aroused to take action on internal community problems. There are three distinctive features common to these four cases: 1) each involved an outside consulting agency in the process of initiating the local program, 2) each developed an action organization to act on behalf of the whole community, 3) each program was organized to last over an indefinite period of time. Research was conducted in each community through interviews with local citizens and a study of local documents.

Two different plans of operation were involved and were identified as the community council approach and the

self-study and development approach. Each approach was described according to the following divisions: 1) Ideology (including the philosophy underlying the model, the objectives and the functions of the action organization), 2) Mechanics of Operation (including the stated procedures of initiation, organization, execution of projects, and maintenance of the action group).

Four methodological problems were posed and answered in the following manner:

1. What kinds of influence were produced in each community?

Twenty-one hypotheses were tested which were directed toward the nature of citizen participation in the program, their perception of it, the range of action, the effects on the social organization, and the capacity of the program to maintain itself.

The amount of influence produced in each community was measured by means of the following indexes: citizen awareness of the program's existence, citizen attendance at meetings, and citizen participation in action projects. Random samples were selected in each community as a basis for measuring the extent of this influence.

2. What implications does the evidence have for practitioners in meeting the objectives of the action program?

After observing the ideal models in operation it was possible to identify problems which were unanticipated in the beginning of each program. These problems were discussed according to the following subjects: the adaptability of the models to the size of the community, organizational complexity and citizen apathy, financial support, power and legitimation to operate in the community, the opposition, differential perception, and cycles of activity. An outline of what appeared (from this analysis) to be functional prerequisites to the survival of the action organization in the community was included at the end of the chapter.

3. What were the major determinants of influence created in the communities?

The major determinants of influence were interpreted as: 1) the formal requirements of the model placed in operation, 2) the role of the consultant in the community, 3) the nature of the external system in contact with the action program, 4) the internal composition of the community. The kinds of influence observed to have been exerted by each of these factors were discussed in detail.

4. What are the elements underlying the process of community development as they are purposively conceived in action?

The development process was analyzed in one community with respect to those elements significantly effecting culture change. The analysis was divided into the following phases: 1) the process by which a new concept is transformed into new belief 2) the process by which this concept is transformed into new beliefs, 3) the process by which new skills and new knowledge is acquired, 4) the process by which these new elements are transmitted to the whole community.

Implications for future research was discussed in terms of: 1) action structures, 2) action methodology, 3) illusions of leadership, 4) delayed response. Findings which were unanticipated in the beginning of the study were recorded in the form of hypotheses for future research.

The Appendix contains an historical account of the community movement.

Microfilm $5.80; Xerox $20.40. 456 pages.

SOCIAL CONTROL AND ANOMIE: A STUDY OF A PRISON COMMUNITY

(L. C. Card No. Mic 59-2840)

Richard Andrew Cloward, Ph.D.
Columbia University, 1959

Purpose

The primary purpose of this study was to test aspects of the theory of anomie, and to suggest possible extensions and revisions of that theory. The principal hypotheses were drawn from the works of Emile Durkheim and Robert K. Merton.

Setting

This study was conducted in a military prison, located in an eastern state, which housed approximately 1,500 Army and Air Force prisoners who had been confined for periods of at least six months, and who had been assigned Dishonorable Discharges.

Hypotheses

This dissertation is basically a study of the relationship between processes of social control and patterns of deviant behavior. The general hypothesis which guided the study was that processes of social control often generate the very behavior they were intended to avert. More specific hypotheses may be stated as follows:

1. That the custodian seeks to secure docility and passivity by inducing high levels of aspiration among inmates regarding reintegration in the conventional community upon release from confinement.
2. That despite high levels of aspiration, most prisoners ultimately come to perceive that access to socially conforming statuses upon release is closed to them.
3. As a consequence of these discrepancies between aspirations and expectations, an intense pressure toward deviant behavior is generated.

Methodology

A panel method was employed. One hundred men were selected at the point of admission to the institution. They were first interviewed within ten days of admission, and then at intervals of eight weeks, for a total of five observations.

Findings

The general hypotheses regarding the self-defeating character of incentives to rehabilitation were confirmed. The question was then raised as to how the resulting pressures toward deviance were managed by the custodian. It was found that the custodian sought to contain deviance by engaging in processes of structural accommodation. Structural accommodation is a process in which certain

inmates (the most dissident ones) are permitted differential access to power, prestige, and material goods and services. Structural accommodation, in short, leads to the emergence of an inmate elite.

Because the inmate elite come to have a vested interest in the maintenance of the status quo, they exert a constant influence for docility and passivity among the disprivileged in the inmate system. The conclusion is therefore advanced that the inmate elite constitute the primary source of social control in the prison.

Once an elite group has been created, new pressures for deviance arise. This occurs because elite positions are not infinitely available. Hence some persons who would like to become upwardly mobile in these illegitimate opportunity structures are blocked. Such limitations on illegitimate opportunity often result in aggressive, rebellious behavior.

Collective disturbances may occur in either of two ways. First, limitations on illegitimate opportunity, resulting in rebellious, aggressive behavior, may "touch off" crises. Normally, however, the "heroes" of the prison are suppressed by the inmate elite. Second, changes in administrative practices may result in a disruption of the accommodative patterns upon which the elite depend for the maintenance of their lofty positions. When the bases of their power and prestige are disturbed, they may then precipitate crises situations. In this view, riots and strikes are not revolutionary; the elite do not seek to generate a new and better set of conditions for the mass of inmates. Rather, they seek to restore the status quo ante - which is to say, they seek to restore processes of structural accommodation and thus their own advantageous positions in the inmate system.

Contribution to Theory

The major contribution of the study lies in a suggested extension of the theory of anomie. This theory focusses upon pressures for deviance which originate in limitations on access to success-goals by legitimate means. As a result of these pressures, it is said that some persons will resort to illegitimate means (e.g., such as criminal behavior) in order to achieve success-goals. However, there is an assumption here that although legitimate means are limited, illegitimate means are widely available. But, as this study shows, illegitimate means are often quite restricted. Hence, some persons undergo a process of "double failure" - in which they are denied access to success-goals by both legitimate and illegitimate means. It is suggested, therefore, that the theory of anomie be extended to include the concept of differentials in access to success-goals by both legitimate and illegitimate means.

Microfilm $3.15; Xero. $10.80. 242 pages.

SOCIAL INTEGRATION AND PERSONAL ADJUSTMENT

(L. C. Card No. Mic 59-2577)

Eunice Cooper, Ph.D.
Columbia University, 1959

This study is a contribution in the general area of the relationship between social structure and personal adjustment. It is a secondary analysis based on data from a quasi-experimental study of factors influencing ease of transition to Army life, conducted by the Research Center for Human Relations of New York University during the summer of 1952.

The present study investigated the influence upon personal adjustment of two types of social integration: one represented by attitudes toward formal aspects of the social system under observation; the other by informal group relations at the squad level. On the basis of previous research it was expected that informal group ties would have more impact on personal adjustment than would attitudes toward the more formal aspects of Army life.

A random sample of 443 recruits was interviewed twice, immediately upon arrival at the basic training installation and again near the end of the seventh week of training. A personal interview and replies on a self-administered mental health inventory, the Wilkins-Miles inventory, were obtained each time. Measures of social integration were taken from the personal interview. The Wilkins-Miles inventory was modified to yield six indices of personal adjustment, some items from it being dropped and others, from the personal interview, added.

The men were assigned to squads on the basis of their scores on the Army Aptitude Area I test in such a way that there were three types of squads in one particular AAAI quartile; incompletely heterogeneous squads -- consisting of men from the three lower quartiles, but none from the top quartile; completely heterogeneous -- including men from each quartile. Squad composition served as an objective criterion of one of the structural characteristics of the social environment.

By and large the influence on personal adjustment of attitudes toward formal aspects of the social situation was greater than that of informal relations. Personal adjustment was positively influenced by a favorable view of Army regulations, demands, ideological goals, etc.: in general, by aspects of the environment perceived as "making sense" and as having regularity, stability and order. Membership in a squad which included men on higher aptitude levels than one's own was the most favorable condition for personal adjustment; being at the top aptitude level of a squad which included men in lower aptitude quartiles was the least favorable. The only aspect of informal relations, or squad cohesion, that had a close positive relationship with the adjustment indices was designation of one's squad as "different." However, this in turn was related to membership in a squad which included men in higher quartiles than one's own.

These findings were contrary to expectation in that in the particular situation investigated, informal group relations did not emerge as a significant and benign factor in personal adjustment. Among the characteristics of this situation were: membership was involuntary -- the men had all been drafted; assignment was temporary, new assignments to be made after basic training; the men were

highly task oriented and had had no former direct experience with their tasks; the groups to which the men belonged were totally new, with no already established tradition of pattern of relationships. Generalization of findings is limited by these and other considerations. However, the study suggests that sources of emotional support do not reside exclusively in the establishment of affectional ties in small groups; that formal characteristics of work organizations such as the Army, factories or schools can be established so as to reduce insecurity and tension; that participation in a well-run, rational, formal organization may itself be a strong source of support.

Extensive tables and appendices on the measures used and on the statistical analysis of findings are included.

Microfilm $2.20; Xerox $7.80. 166 pages.

CHURCH-SECT TYPOLOGY: AN EMPIRICAL STUDY

(L. C. Card No. Mic 59-2714)

Russell Rowe Dynes, Ph.D.
The Ohio State University, 1954

The dissertation is concerned with the contrasting typologies of Church and Sect. Various formulations of these types are found in the literature of both theology and sociology. The Church has generally signified a type of religious organization which accepts the social order and integrates existing cultural definitions into its religious ideology. The Sect, as a contrasting type of religious organization, renounces the idea of conforming to the social order and stresses rather rigid behavioral requirements for its members. These general types, and a number of specific distinctions based on the work of Liston Pope, were used as the bases for the construction of an attitude scale, the principal measurement technique used in the study.[1]

Scale Construction

An initial 53 item scale was constructed based on these polar types. The scale was pretested on a sample drawn from a Protestant church in Columbus. After revisions on the basis of the pretest, the final scale contained 24 items. The mean scale value difference for the items used with the final sample was 1.3; between extreme quartiles ranked on total score, 21 of the items showed differences significant at the .001 level. For two successive samples, the scale showed corrected split-half reliability coefficients of .82 and .92. The validity of the scale was inferred from two different types of evidence. First, among ten judges, there was 98 per cent agreement on each item's relation to the general theoretical type and 84 per cent agreement as to each item's placement in relation to the 16 specific distinctions contrasting these two types. Second, scale scores of members of religious organizations manifesting Sect traits (Baptist, Holiness, Pentecostal, and so forth) were compared with those of members of religious organizations with Church traits (Presbyterian and Episcopal). The mean difference between these groups was over 24 scale points, significant beyond the .001 level.

The scale, in questionnaire form, was sent to a random sample of the adult population in the Columbus Metropolitan Area. Since the study was confined to Protestantism, an initial sample loss of 25 per cent from the presence of non-Protestants in the list was anticipated. Returns of the questionnaire were elicited by the initial mailing, two follow-up postcards, and a second questionnaire mailed to every fifth non-respondent. The study was based on 360 returns, which constitutes 35 per cent of the estimated Protestant sample.

The Analysis of the Typologies

The first area of interest in the study was the relationship among the various dimensions composing the typologies. The data yielded by the items of the scale were used, first, to analyze the consistency of response across the several dimensions of the constructed types. Two sources of evidence indicated this consistency. This was indicated, on one hand, by scores of individuals who closely approximated the theoretical limits (the ideal type) on the scale. While the theoretical limits of the scale ranged from 24 to 120, the actual range from the sample was 33 to 105. On the other hand, 23 of the items showed positive scale value differences, indicating that individuals with the highest total score on the scale yielded higher mean scores on each of these particular items than did those with lowest total scores.

The items were also analyzed in reference to their ordering in the gradation from Sect to Church. First, mean scores of each item gave some indication of the item's susceptibility or resistance to change. Second, the scale value difference of each item gave some indication of the degree of intensity of response that an item might evoke. Third, the percentage of internal consistency among responses to all of the items was computed and, from this, an analysis of item interrelationships was made. Utilizing these three measures indicating position, intensity and consistency, a sequence of change between Sect and Church was suggested.

Scale Scores and Socio-Economic Status

The major relationship tested was that between the Church-Sect Scale scores and socio-economic status. It was hypothesized that an increase in socio-economic status would be associated with an increase in the degree of acceptance of the Church type of religious organization. Socio-economic status of individual respondents was estimated by three different measures: first, by the year's of education he had completed; second, by the placement of his occupation in the Census Occupational Classification; third, by the rating of the prestige of his occupation on the North-Hatt Scale. Consistent and statistically significant differences were found between categories of respondents with all three of these measures. An increase in education accompanied movement away from Sectness and Churchness. An increase in occupational prestige was associated with increasing Churchness.

While certain denominations manifest traits which the scale tried to measure, it was hypothesized that these traits were the result of socio-economic factors correlated with membership in certain denominations and not simple consequences of membership. If the attitudes measured by the scale actually varied with socio-economic status, members of the same denomination differing in occupational prestige would show corresponding differences in scale score. When the Mothodist and Presbyterian groups in the sample were dichotomized into prestige categories, differences significant beyond the .01 level were

found. The attitudes measured by the scale, then, seemed to vary with socio-economic status, irrespective of assumed doctrinal position and denominational affiliation. Other social background variables had no appreciable association with scale scores.

Culture Shock

The Sect has been mentioned in the literature of sociology as playing an important part in cushioning the "culture shock" experienced by rural migrants in cities. This hypothesis was tested in several different ways. Those individuals who had spent their youth in rural areas showed a lower mean score (more Sectarian) than those from urban backgrounds. In addition, those individuals who had migrated from the predominately rural states of the South showed lower scale scores than did either those from Ohio or those from Northern states. The difference between extreme groups in both instances, however, was less than five scale points. Contrary to the hypothesized relationship, recent arrivals to the urban area of Columbus did not have the lowest scale scores. Because of closer association of the scale and socio-economic status, it is suggested that the Sect functions as an accommodative device for lower socio-economic groups in general rather than for rural migrants in particular.

Social Participation

Another area of investigation was the relation between these attitudes and the individual's participation in groups both within the church and outside the church. For Sectarians, their religious affiliations were their most meaningful associations and sources of friendship. This was indicated by the fact that they attended church more often, belonged to more groups within the church and fewer groups outside the church, stated almost unanimously that they derived more satisfaction from these religious participations than from "secular" participations, and drew most of their close friends from within their church. For those holding Churchly attitudes, their religious affiliations seemed to provide only nominal satisfaction and a relatively small part of their total participations. Their friendship circle extended past the church and included only a few of their fellow members.

Attitude Correlates

The relation between these Church-Sect attitudes and certain other attitudes was tested. Sectarians, who were from lower socio-economic levels, were "economically radical" in the sense that they saw value in governmental ownership of military aircraft production; those with Churchly attitudes were almost unanimously convinced that private ownership is the best way. Sectarians, in addition, felt that there were numerous factors outside of the individual which control life; those with Churchly attitudes felt assured of their own part in controlling their lives. Sectarians also were found to be more satisfied with their present church and assessed the role of religion in their lives as being more important than did those with higher scale scores.

Denominational Change

Some analysis was made of movement between denominations. The various denominations were tentatively placed along a continuum from Sect to Church by means of the mean score of members at the point on the continuum for the whole denomination. In general, movement between denominations appeared to be toward denominations expressing a more Churchly ideology. Sectarians showed slightly higher rates of denominational and church changes and gave more "religious" reasons for their changes. For most, however, changes in religious affiliation appeared to be related to residential changes. Since age was not related to frequency of change, it was suggested that much change in religious affiliation is related to upward social mobility and accompanies movement to ecological areas of higher prestige.

Microfilm $2.00; Xerox $5.80. 116 pages.

1. Pope, Liston. Millhands and Preachers. New Haven: Yale University Press 1943.

Abstract published by special arrangement with The Ohio State University.

ORIGIN, STRUCTURE, AND PHILOSOPHY OF JOB EVALUATION

(L. C. Card No. Mic 59-2715)

John William Thompson Elrod, Ph.D.
The Ohio State University, 1954

Job evaluation, as conceived and applied in our contemporary economic and industrial society, is a recent development. The idea of systematic wage determination was beginning to form, before World War I, but it did not crystallize until the early 1920's. Even then, its spread and adoption was relatively slow, and not until the late thirties, with the rapid growth of industrial type unions, was general interest evoked. World War II and subsequent events further accelerated the use of job evaluation. But this method of determining wage differentials did not originate by accident; rather it was the result, or the contingent phenomenon, of many forces that had been in effect for centuries and were stimulated by changing economic, social, and technological developments.

Job Evaluation has been defined, in operational terms, as "the ranking, grading, and/or weighting of essential work characteristics of all jobs or job classes in some systematic way to ascertain the labor worth of each job or job class relative to all others."[1] A number of different systems, or plans, with many variations of each, are in use, not only in industry, but in every type of activity in which wage differentials and administration is an important consideration. Although accurate figures are not available, it is estimated that at least one-third of all companies utilize some form of systematic wage differential determination. The use is more prevalent in larger companies, where job characteristics and relationships are more complex than in smaller companies. Details of the operation and administration of job evaluation plans may be found in such references as Otis and Leukar[2]; Patton and Smith[3]; Benge, Burk, and Hay[4]; and others.

From a survey of the history of wage differentials, it is evident that the techniques and concepts of job evaluation are products of the twentieth century and are indigenous to those countries with the free enterprise philosophy of industry. It is also evident from an analysis of attitudes regarding work and wages from the early beginnings of economic activity that some of these attitudes persist

today. The general aversion to working with one's hands, and the approbation of pursuits requiring mental application and training of the mind, is not a twentieth century phenomenon, but can be traced to the dawn of history.[5] An important phase of economic life until recently was that of slavery, for slaves performed much of the manual work of the world. This arrangement was accepted by all peoples and strongly influenced economic and moral thought. Although slavery has vanished from the American scene (less than 100 years ago), the attitude of many employers for a long time was that employees, especially those performing manual work, or apprentices, were, in a sense, "owned" by them. Certainly the fact that slaves were generally maintained at a subsistence level influenced the trend of minimum wages (for those who did the unskilled, manual labor) for hundreds of years.

Wage differentials have always existed and have been based to a large extent on such factors as the status of the craft or the class (i.e., slave, freeman, apprentice, journeyman, master, professional man, etc.), economic forces, and, of course, the bargaining power of the parties involved, which is based in part on the above factors and in part on the immediate situation. Undoubtedly, status was achieved by, or accorded to, those crafts or professions, partially at least, on the basis of the skill required, or the difficulty involved, or the risk inherent, in the performance of the work. As the status of a particular craft became established, it solidified into tradition. The relative earnings and wages also became traditional, and formed a very real concept in the minds of workers, particularly in the unions. The Industrial Revolution had an important effect on this status system, reaching a high point with the advent of extensive mass production activities. The conflict between capital and labor can in part be attributed to the opposing forces of traditions and technological change. The employers were also following traditions perhaps older than those of craft status. Job evaluation is a concept concomitant with technological change, and most of the plans attempt an objective, systematic, logical solution to wage differentials based on job content only. While it can be argued that status is based on job content, the according of status was an entirely subjective process, evolved over long periods, and in many cases the job content changed but the status remained. Nevertheless, the traditional aspects of wages and jobs are a very real concept in people's minds. Thus it is found that conflict will arise in the application of job evaluation programs, because although the results may be logical, they differ with tradition. (There are other reasons for difficulties with the installation of job evaluation programs, some of which are technical, some of which are administrative. Failure to include the employees, or their union, in the program is such a reason, underlying which may be the fear or belief on the part of the employees that "traditional" rates and differentials will be ignored.)

A fundamental question arises regarding the relationship between tradition and the logical, job-content approach of most evaluation plans. Tradition, of course, is difficult to identify and measure. Does the current wage structure fairly represent this idea? and, How important is it that such be considered? might be justified questions in this case. A number of steel companies sponsored an applied research program[6] to develop a job evaluation plan based on the assumption that the wage structure then generally used was a valid criterion for the evaluation of jobs because it represented negotiations and wage developments that might be termed traditional. The factor comparison type of job evaluation plan[4] also utilizes current rates of "key" jobs as the basis for establishing the rating scale. These key jobs normally are those which are stabilized and well known, and for which the rates are already acceptable. This is the type of condition conducive to formulating subjective status concepts about jobs; this concept is transferred into the evaluation process by means of the key jobs.

The subjective, traditional, status type of conception also has another but related role in the process of determining relative wage rates. The theory is that in a job evaluation rating process the raters enter into the process with an open, but not vacant, mind. That they have biases is acknowledged, but if the results are to be objective, no preconceived ideas as to the final rate structure is allowed. However, if one examines the findings and data of the investigations of Lawshe[7] and other researchers, it is evident that the raters did have preconceived ideas regarding the final ratings and evaluated jobs on the various characteristics (factors) in such a manner that the jobs which they subjectively place high on the total scale received that kind of point value. The fact that in one study Lawshe[7] found that "skill demands" accounted for 99 per cent of the total variance is as much an indication of general tendency toward assigning points for individual factors in accordance the preconceived relationship of jobs, as an indication that "skill" was the only determinant of job worth in the minds of raters.

Additional research is needed to verify the hypothesis that job raters under the point type plans assign individual factor values in accordance with their preconceived ideas or impressions as to the relative positions of the jobs. If this hypothesis is not proved false, it would mean that such job evaluation plans (or their application, to be more exact) are not in the true sense objective, but, more correctly, are devices for systematically reaching preconceived conclusions. The theory behind the steel companies' plan and the factor comparison plan lend credence to this hypothesis.

Approximately 75 per cent of all job evaluation installations are of the point rating type. It might be reasoned that if these installations are "successful," one factor in that success would be that the traditional rate structure had not had time to crystalize and thus present conditions for preconceived ideas. This latter is somewhat of a remote possibility because of the carry-over or transfer of such concepts from one industry to another.

The various administrative and operational problems connected with job evaluation have an important bearing on the success or failure (synonymous with continuance or discarding) of any given program. As a matter of fact, a poorly conceived plan can, by aggresive and thorough management, be made to "work," whereas a carefully constructed plan may fail to live up to expectations as the result of poor administration. The acceptability of a given plan to a union (one type of subjective criterion on which job evaluation plans may be judged) may not be determined by the excellence of the plan itself, but by the sincerity, general ability of management, and the status of the relationships between union and management. Although it is not feasible to determine the magnitude of errors or the effect of such factors (administrative, etc.) in the final wage structure, it would appear that some of the technical

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

errors or defects in the details of the plan itself are not the most important elements.

From another viewpoint, if the employees and the union are convinced that the job evaluation program is a sincere attempt on the part of management to correct wage rate inequities, and the management welcomes participation by employees, such a program can be the vehicle for increased understanding and better relations among the union, employees, and management. It thus behooves management to be fully informed and aware of the assumptions, the problems, and the type of results that may be expected from the different types of job evaluation plans. It is these latter type of considerations that pertain to the present writing.

The role of habits of thought and tradition was emphasized above, yet if wage inequity problems could have been solved by these subjective concepts, the analytical approach of job evaluation would never have been found necessary. It was precisely the breakdown of these methods in industries where job content was rapidly changing because of technological advances and wage rates had to be determined before tradition, status, and other subjective measures were fixed to any degree in peoples' minds that necessitated the introduction of job evaluation. That systematic, logical methods can yield results which do not conflict with traditional concepts is an indication that the fundamental theories and approaches of job evaluation are sound. It also indicates that the general thinking regarding objectivity, omission of consideration of current rates, traditional structures, and negotiation of wages on the basis of the evaluation process, needs re-orienting. Again it is necessary to point to the steel companies' research and development of a plan based on the assumption of the validity of the general wage structure in the industry.

If any broad conclusion can be drawn regarding job evaluation, it is that a proper blending of the objective techniques (which obviously need refining) and the subjective concepts related to wage differentials (which are the product of centuries of habit of thought and tradition and certain economic forces) is necessary for continued advancement in this field. Microfilm $5.05; Xerox $16.80. 394 pages.

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OCCUPATIONAL MOBILITY IN SOCIAL WORK: THE JEWISH CENTER WORKER

(L. C. Card No. Mic 59-2848)

Melvin Herman, D.S.W.
Columbia University, 1959

This is a report of a study which attempts to uncover some of the major factors which tend to produce occupational mobility among full-time workers employed in Jewish Community Centers in the United States and Canada.

A fifty percent sample (316) was chosen at random from the professional personnel employed in these Centers as of January 1, 1956. From records maintained at the National Jewish Welfare Board, a detailed examination was made of individual work histories. The following kinds of data were extracted: age, sex, marital status, education, total number of social work organizations worked for, number of years in social work, number of years worked on previous jobs, job titles in all social work positions, and salaries received.

A lengthy questionnaire designed to gather information dealing with a wide variety of attitudes and perceptions concerning their work was mailed to all those in the sample. It included direct questions of the multiple choice or yes-no variety, questions in which rank order of preference was sought on several matters relating to job satisfaction, questions securing information on personal background and characteristics, and a final free-answer type question designed to elicit general attitudes toward job mobility. After the original mailing and two follow-ups, 88.3 percent of the questionnaires were completed and returned.

In addition, all personnel reports submitted by 140 affiliated agencies for the period 1950-1955 were analyzed to determine the amount of turnover, the patterns of filling vacancies, numbers of personnel employed and their titles, and salaries paid for different positions.

The study finds that this field stimulates the desire for movement and determines the ways in which actual movement takes place. Agencies vary in size with the 2-3 man center being most numerous. Less than one-tenth of the agencies employ one-third of all personnel. The workers are young, with the median age being under 35. Older workers, mostly in top jobs, generally have had little professional education, while the younger group usually possesses a Master's Degree in Social Work. Salaries vary with position and agency size.

Mobility declines with age. The rate of movement is less for those who are Executive Directors irrespective of age. Workers possess a high degree of propensity to movement, with propensity varying inversely with position in the job hierarchy. Levels of aspiration are high. The typical worker expects to become an Executive Director earning more than $10,000 per year. Many workers perceive that their colleagues are moving more frequently than they, and hence are advancing more rapidly. This perception is felt to produce "status anxiety" and consequently propensity to move.

Evidence is found of only an insignificant amount of vertical movement or movement out of the field. More than 40 percent of all job changes are horizontal with diagonal change accounting for an equal proportion. Most job changes involved an increase in salary. The percentage increase seems to be substantially greater than the increment the worker would have received if he remained on the

job. The salary structure reduces vertical movement which in turn encourages horizontal and diagonal change.

A final section of this study presents a series of recommendations geared to reducing movement in this field.

Microfilm $2.55; Xerox $8.80. 193 pages.

KNOWLEDGE AND OPINIONS CONCERNING CANCER WITH RESPECT TO LANGUAGE, RELIGION, SEX, AND AGE DIFFERENCES IN A SMALL CANADIAN TOWN

(L. C. Card No. Mic 59-2895)

Richard Laskin, Ph.D.
The Pennsylvania State University, 1959

In 1957 a research project, sponsored by the Canadian Cancer Institute and designed to evaluate the effectiveness of various cancer education techniques, was conducted under the auspices of The Department of Psychiatry at McGill University. A certain portion of the wealth of data collected has been analyzed here in an attempt to investigate possible differences in knowledge and fear of cancer on the basis of language, religion, sex, and age breakdowns of the sample studied. This sample (260 respondents) was drawn from the population of a small town in southern Quebec. Interviews took place mainly in the homes.

Since one of the purposes of the study was to make recommendations to educational organizations which are attempting to reduce cancer treatment delay (and thus lower cancer mortality rates), an investigation of the literature was made to determine the possible relationship between knowledge and fear of cancer on the one hand and delay on the other. This investigation yielded evidence in support of the supposition that such a relationship does exist.

Four major questions formed the core of the study. Three of these concerned ignorance about cancer and one was concerned with fear. Thirty-one null hypotheses were formulated to test the possibility that different language-religion, sex, and/or age groupings varied with regard to ignorance about and fear of cancer. Some of the questions were combined so as to create mean standard scores for each grouping which could be compared by t tests or by analysis of variance. In addition a thorough item analysis was performed which employed the chi square test extensively.

The result of greatest significance was that the French-Catholic and English-Protestant sub-samples differed greatly on every question asked. The French-Catholics were less well prepared to give an acceptable definition of cancer, to name its signs and symptoms, and to properly determine its possible curability. What is more, they appeared to be more fearful of the disease, less informed about its hereditary aspects, and, as a group, seemed to harbor a great many more serious misbeliefs about cancer causes and cures.

These language-religion groupings were examined independently with respect to sex and age breakdowns. All questions yielded statistically significant or nearly significant results in one or another of the comparisons. The results indicate that sex and age are variables which do have a relationship to ignorance and fear of cancer. What is more, it seems certain that other independent variables (e.g. occupation, educational level achieved, or social class) also bear investigation in this regard.

The study strongly suggests that public educational organizations interested in combatting cancer, or other health hazards, should take cognizance of the differential needs of the various subgroupings within the society. It reveals that a great deal of research is necessary in this area. An interdisciplinary investigation to determine what behavioral factors are most closely related to health problems such as cancer treatment delay is probably most needed. There seems to be no doubt that a broad and important area of medical sociology lies open here.

Microfilm $2.30; Xerox $8.00. 173 pages.

MANDARIN AND EXECUTIVE: ELITE MOBILITY IN CHINESE AND AMERICAN SOCIETIES

(L. C. Card No. Mic 59-2587)

Robert Mortimer Marsh, Ph.D.
Columbia University, 1959

A long tradition of social theory has identified the family and kinship as among the primary sources of "the strain toward aristocracy" in society. Given a solidary kinship unit, the sons of occupational elites are more likely to enter elite occupations themselves than are the sons of lower strata individuals. The more solidary the kinship unit, the more likely it is that this will happen. Two major hypotheses are derived from this body of theory and are tested in this study:

(1) Occupational elites in Chinese society from 1600 to 1900 and in twentieth-century American society tend to be recruited from high- rather than from low-stratum family backgrounds.

(2) The amount of intergenerational vertical mobility observed in the occupational elite of a given society varies inversely with the degree of kinship solidarity--the strength of the extended family system--in that society. China between 1600 and 1900 is shown to have had a higher degree of kinship solidarity than twentieth-century American society. Therefore, it is hypothesized that the Chinese occupational elite exhibited less intergenerational vertical mobility than comparable American elites.

Data to test these hypotheses are drawn from several studies of the "social origins" of American governmental, business and intellectual elites, and from a sample of 572 government officials in China during the Ch'ing period. Data on the family backgrounds and elite mobility of the Chinese sample were obtained by extensive use of Chinese and Western language biographical and official sources.

These data support both hypotheses. Chinese and American elites were recruited disproportionately from elite or near-elite family backgrounds. The American elite samples uniformly show a higher percentage of elite upward mobility than do the Chinese data.

It is concluded that even in societies as dissimilar in many respects as are Chinese and American: first, intra-societal differences in intergenerational elite mobility can be predicted by the factor we have termed the stratum position of the family of orientation. Second, inter-societal

differences in intergenerational elite mobility are inversely related to the degree of kinship solidarity. The relatively "weak," structurally isolated, American nuclear-neolocal family is better adapted to intergenerational mobility at the elite level than was the "stronger" traditional Chinese extended family.

Sociological analysis is all too often ahistorical. When historical data do play any role at all in sociology, it is in the form of merely anecdotal "illustrations." The present study has attempted to use systematic historical data in order to test hypotheses in the area of social organization. Chinese historical materials are particularly rich, and lend themselves well to studies of bureaucratic structure and function, official recruitment, and career mobility.

Microfilm $4.30; Xerox $10.60. 336 pages.

A STUDY OF SELECTED FACTORS ASSOCIATED WITH THE PROFESSIONAL BEHAVIOR-IMAGE OF PROTESTANT PARISH MINISTERS

(L. C. Card No. Mic 59-2901)

Beryl Blake Maurer, Ph.D.
The Pennsylvania State University, 1959

The research problem was twofold. (1) Are there variations in the Protestant parish minister's professional behavior-image associated with variations in selected environmental, institutional, and personal factors? (2) Is the greatest amount of variation in the professional behavior-image associated with the rural-urban factor of the parish environment?

Procedure

The study was theoretically conceived in terms of field theory. That portion of the minister's perceived field related to his professional behavior was identified as the minister's professional behavior-image and made the central focus of the study.

Five sub-patterns of professional behavior made up the professional behavior-image, (1) professional self-image, (2) practitioner role-image, (3) image of the church, (4) image of community, and (5) image of society. The professional behavior-image was designated as the dependent variable.

The independent variables were selected from the three major components of the minister's objective field: the church, the parish environment, and the minister himself. The seven factors selected as independent variables were: (1) from the parish environment: rural-urban, metropolitan-nonmetropolitan, and region, (2) from the church as an institution: organizational complexity, and per-capita-giving, and (3) from the minister: age, and occupational mobility.

Two hypotheses guided the study (1) There are significant differences in the professional behavior-image of Protestant parish ministers associated with selected parish environmental, institutional, and personal variables, (2) There are significant differences between the degree of variation in the professional behavior-image associated with rural-urban, and that associated with the other selected parish environment, institutional, and personal variables.

Statistical analysis involved three nonparametric techniques designed for the nominal level of measurement involved in the study, (1) The Coefficient of Contingency, (2) The Wilkerson adaptation of the Binomial Test, and (3) The Wilsoxon Matched-Pairs Signed-Ranks Test.

The sample consisted of 581 Protestant parish ministers who had responded to a mailed questionnaire in the Russell Sage Foundation project "Training for the Ministry." Twenty-two Protestant denominations from all sections of the nation were represented. The sample was standardized on the basis of (1) education (possessing college and seminary degrees), and (2) active participation in the parish ministry.

Findings

1. Significant differences in the professional behavior-image of Protestant parish ministers were found to be related with the rural-urban metropolitan-nonmetropolitan, and region factors of the parish environment; the institutional factor, organizational complexity; and the personal factors age, and occupational mobility.

No significant differences in the professional behavior-image was found related with the institutional factor, per-capita-giving.

2. No significant difference was found between the degree of variation in the Protestant parish minister's professional behavior-image related with the rural-urban factor, and that related with organizational complexity.

Significant difference was found between the degree of variation in the professional behavior-image related with the rural-urban factor, and that related with the other parish environment, institutional, and personal factors: metropolitan-nonmetropolitan, region, per-capita-giving, age, and occupational mobility. In each case, the degree of variation related with the rural-urban factor was significantly greater than that related with each of the other factors.

3. The relationship of the selected environmental, institutional, and personal factors with the Protestant parish minister's professional behavior-image varied inversely with the degree of institutionalization. Highly institutionalized areas were characterized by homogeneity of professional behavior and showed limited relationship with the selected factors. Conversely, areas of limited institutionalization were characterized by heterogeneity of professional behavior and showed significant relationship with the selected factors.

The results of the study indicate (1) the desirability of a re-examination of the position which builds church program and practice around the traditional rural-urban dichotomy. The traditional division is an arbitrary one which has limited value in modern society, (2) greater recognition should be given to the significance of complexity of church organization as a determinant of church program and practice, and (3) church executives should recognize the limitations of a single factor basis of program administration.

Microfilm $4.60; Xerox $15.40. 359 pages.

JEWISH-GENTILE COURTSHIPS: AN EXPLORATORY STUDY OF A SOCIAL PROCESS

(L. C. Card No. Mic 59-2864)

John E. Mayer, Ph.D.
Columbia University, 1959

What are the post-contact influences that lead individuals to marry those whom they had formerly looked upon as being maritally unsuitable? Or, putting the question more generally, how does it happen that individuals become intinmately associated with persons who were regarded, at an earlier point, as being unfit or unqualified? By interviewing Jews and Christians who had been intent upon contracting an in-group marriage but who subsequently married out, it was hoped to throw some light upon this problem. More specifically, we hoped to be able to identify some of the factors accounting for the marriage and to develop hypotheses in explanation of the outcome.

The names of intermarried persons were obtained through the following kinds of intermediaries: our acquantances and acquaintances of theirs; rabbis, priests, and ministers; students who were attending certain of the city colleges; and mixed couples who were subsequently interviewed. We solicited only the names of mixed couples in which one or both of the partners were believed to have been confronted with considerable parental opposition during the courtship. Such a procedure, it was felt, would more likely put us in touch with the types of intermarried persons we were looking for than would interviewing just any mixed couples called to our attention.

In all, forty-five couples, living in the New York metropolitan area, were interviewed during 1954. The partners were spoken with separately but at the same time. While I interviewed the husband, my wife interviewed the wife. The research objective was to search out and explore a wide range of influences, rather than to concentrate intensively upon a more circumscribed range. With this end in.view, the respondent's marital decision was visualized as being not only a function of what happened between himself and his partner, but in addition as being a function of his relationships with his parents and his friends. Within each of these three sets of relationships, the respondent's attention was directed to certain areas and topics which it was felt might be causally relevant to his marriage.

At the conclusion of the interview stage, we separated out those individuals who gave evidence of having been definitely resistant to contracting an out-group marriage. There were twenty-nine such persons -- referred to as "Reluctants" by us -- and it is their courtship histories which form the core of the current study.

The conditions promoting their marriage -- at least those considered in the text -- can roughly be grouped under the following headings: 1) A few of the Reluctants were initially unaware that their partners' ethnicity was different from their own. 2) Their partners were visualized as being very appealing in certain ways, and their appeal offset the offensiveness of their "alien" affiliation. Either their partners were especially interested in them and/or their partners possessed certain highly prized "objective" characteristics. 3) Once the Reluctants had become romantically interested, there were some who felt assured they would not become further involved. Convinced that the affair would remain casual, they continued to date -- which led, counter to their expectations, to their becoming more closely attached. 4) Most of the Reluctants felt assured that if they got married, their religious orientation would prevail. Their assurance in this matter led the other's ethnicity to become a less potent deterrent. 5) The image that their parents had of the romance failed to keep abreast of the actual course the romance was taking, with the result that the Reluctants were exposed to less parental coercion than would otherwise have been the case. 6) There were certain conditions that mitigated the impact of whatever coercion was brought to bear, e.g., some of the subjects anticipated that their parents would "come around" in the end. 7) The Reluctants' close friends, when they approved of the affair, tended to articulate their feelings and by so doing offered the subjects considerable support. When friends were disapproving, they tended to remain silent and thereby exerted less negative influence than they might have. In other words, disapproving friends retarded the romance less than approving friends promoted it -- the result being that the composite influence playing upon the Reluctant was skewed toward the positive pole. Microfilm $4.35; Xerox $14.60. 340 pages.

YOUNG JUDAEA: A SURVEY OF A NATIONAL JEWISH YOUTH MOVEMENT IN 1951-1952

(L. C. Card No. Mic 59-1940)

Norman Schanin, Ed.D.
New York University, 1959

This study presents a nation-wide survey of Young Judaea during its forty-third operational year, extending from September 1951 to September 1952. Young Judaea is the oldest and largest of the national Zionist youth movements in the United States. This investigation considered data bearing upon the status of Young Judaea in order to determine the nature of its program and the processes through which the national goals are implemented.

The achievements and problems of Young Judaea were examined in terms of its historical development, the American Jewish community setting and its stated goals. Democratic processes were observed in considering the role of Young Judaea as an agency meeting the interests and needs of Jewish youth in America.

Treatment of Data

Following the determination of the national goals, a ten per cent national sample of local groups was selected for investigation. Seventy-two per cent of the eligible sample provided an adequate return of documentary data. Individual members, leaders and supervisory officials received questionnaire forms. These were supplemented by direct observation reports of groups visited and selected interviews of members and leaders. All of the data collected were organized into the form of case studies of the fifty-four groups used in the sample. In each case study, the data were classified into the categories of members, leaders and supervisory officials, and under the sub-headings of understanding and acceptance of the national goals.

In selected areas of this investigation, data dealing with the total national population of members and leaders have

been used to supplement and validate some of the information collected in the sample.

Conclusions

The major conclusions arrived at were the following:

1. those affiliating with Young Judaea did so out of a desire to find good fellowship, recreational opportunities and a sense of identification and self-fulfillment as American Jews. Zionism and Israel were considered as part of the strivings of the Jewish people for creative survival;

2. the broadness of the Young Judaea goals permitted much freedom for meeting individual interests and needs. The extent of goal realization was dependent upon the effectiveness of the leadership, the organizational structure, the physical settings, the support and supervision received by local groups;

3. the membership group in Young Judaea was superior to the general Jewish youth population in several significant areas considered in this study;

4. the lack of effective leadership had limited the growth of Young Judaea and the full realization of its goals. The leadership was characterized by a preponderance of female leaders, a large annual turn-over and a youthfulness with limited experience and training. This had resulted in sizable membership drop-outs, the early break-up of many groups and an inadequate program development for the groups so affected;

5. organizationally the program for Junior members was weak. There was, also, a substantial overlap of age ranges between Junior and Senior members.

Recommendations

The following recommendations are offered in the study:

1. leadership inadequacies and the nature of the physical facilities used, suggest the need for smaller groups;

2. there is need for a re-examination of both the membership age requirements and the program for Junior members;

3. in order to provide for more effective leadership, greater supervisory assistance and new sources of income, it is necessary to broaden the base of Young Judaea sponsorship. In this connection it is recommended that Hadassah, a current sponsor, fulfill a greater role in Young Judaea commensurate with the ability and interests of its membership.

Microfilm $4.10; Xerox $13.80. 317 pages.

ADJUSTMENT OF RETIRED RAILROADERS: A STUDY OF OCCUPATIONAL RETIREMENT

(L. C. Card No. Mic 59-2541)

John William Tomlin, Ph.D.
University of Maryland, 1958

Supervisor: Dr. Bruce L. Melvin

This dissertation is a descriptive and analytical study of the occupational retirement of railroaders. The major emphasis is on the adjustment of the retired worker as it is conditioned by his previous occupational milieu. Treatment of a large segment of the data has been exploratory because it was found necessary to make definitive the pre- and post-retirement environments and life patterns.

As a social psychological investigation, the study consists of several inter-related parts: (1) a description of the retirement life patterns of railroaders; (2) a description and analysis of their modes of retirement adjustment; and (3) an analysis of the impact of the occupational milieu and its derivative work functions on the process of retirement adjustment. (Retirement adjustment is defined herein as the modification or restructuring of the life pattern in response to the new situation following the worker's withdrawal from his career occupation).

A major focus has been placed on the analysis of the impact of the occupational milieu and its derivative work functions on the retirement adjustment of railroaders. In this regard, a frame of reference used in the study became clear in the treatment of the data; that is, that work activity performs certain functions or has objective consequences for the worker. These functions are: the provision of income, identification, status-giving, association with co-workers, provision for expenditure of time and energy, and source of creativity and self-expression. Furthermore, it is accepted as axiomatic that such work functions, especially well-defined among this occupational grouping, are strongly manifested in the nature of the modes of retirement adjustment.

Case studies were made of a sample of ninety-two retired railroaders, whose names were drawn from the files of the Richmond, Fredericksburg and Potomac Railroad Company. Personal interviews were conducted, with the utilization of structured interview schedules. In addition, portions of some interviews were tape recorded in an attempt to obtain qualitative data to be used for documentation of modal patterns.

The method of interpreting and analyzing the data consisted of three techniques: (1) statistical description of retirement life patterns and modes of retirement adjustment; (2) content analysis of tape-recorded materials; (3) functional analysis of the relationship of work to retirement adjustment. In the functional analysis, which follows the conceptualization of Robert K. Merton, the concepts of manifest and latent functions and functional equivalents were employed.

In general, the findings of this research provide the following generalizations:

(1) Retirement adjustment among railroaders is not characterized by severe modification or restruct turing of the life pattern, concurrent with retirement. Rather, it involves moderately decreased participation in formalized, institutional activities and a continuation and/or augmentation of those other components of the life pattern existent prior to the time of retirement. (Other components of the life pattern include informal social participation and individualistic activities).

(2) The inherent nature of the occupational milieu or railroaders operates against retirement at a fixed age, the assumption being that the normal and desirable retirement age is sixty-five years. Among railroaders, there is a proneness to resist retirement at this age.

(3) The latent functions of work derived from the nature of the occupational milieu are strongly manifested in the retirement situation of railroaders. These latent functions or consequences are: a limitation of the types of organizational affiliation, a strengthening of attachments and relationships with family and kin, and a strong emphasis on involvement in individualistic activities which do not require group collaboration.

(4) Railroaders seem to be fairly successful in discovering and realizing functional equivalents of work in their retirement interests and activities. It is conclusively evident that the types of functional equivalents or work substitutes, for the most part, reflect the impact of the occupational milieu on the retirement adjustment of railroaders.

Microfilm $2.00; Xerox $6.60. 139 pages.

SOCIOLOGY, FAMILY

MARRIED LIFE IN THE MIDDLE YEARS: A STUDY OF THE MIDDLE CLASS URBAN POSTPARENTAL COUPLE

(L. C. Card No. Mic 59-2622)

Irwin Deutscher, Ph.D.
University of Missouri, 1959

Supervisor: Robert W. Habenstein

A new phase of the family cycle is emerging among our contemporary population as a result of increasing life expectancy and decreasing numbers of children per family. This new phase which finds the parents surviving together for a number of years after the departure of their last child is referred to as the postparental period.

This dissertation seeks to describe postparental life among the urban middle classes on the basis of relatively unstructured interviews with 49 postparental spouses representing 31 married couples. The respondents consist of "normal" middle class, middle-aged, urban married persons whose children have left home. They were located randomly in middle class residential areas of Kansas City and were interviewed in their homes. Most of the interviews were tape recorded.

The general hypothesis was that postparental life presents the spouses with a crisis situation in terms of their role definitions and role behavior. Three guiding subhypotheses related the parents' evaluation of the postparental situation to three different role perceptives. The first of these perspectives is the sequence of roles a person is called upon to play as he moves from phase to phase in the life cycle. The hypothesis is that there is a direct relationship between continuity of role conditioning and the tendency to define the postparental situation favorably. In spite of the fact that most of these people did not have the opportunity to observe their parents playing postparental role, nearly all of them have had opportunities of one sort or another to rehearse the role and to anticipate the postparental situation. These socializing opportunities are taken advantage of to varying degrees by different parents. The interviews reveal no evidence to support the hypothesis that there is a relationship between role conditioning and the evaluation of postparental life.

The second perspective deals with the many roles any given person must play at one time of his life. The hypothesis is that there is a direct relationship between these concurrent roles and the tendency to define the postparental situation favorably. Evidence was found to support this hypothesis: people who are deeply involved in roles other than the parental, find the transition to postparental life easier than those who do not have other important interests in their lives. This explains, in part, the lack of evidence in support of the first hypothesis: people who have continuity in other areas of their life do not suffer from discontinuity in the parental role.

The third perspective deals directly with the husband-wife role relationship. The hypothesis is that there is a direct relationship between the complementarity of husband and wife roles during the postparental years and their tendency to define the situation favorably. The evidence indicates that, in spite of the fact that no relationship exists between the spouses mutual activities and their definition of postparental life, there is a relationship between their role complementarity -- mutual support, understanding, and sympathy -- and their definition of postparental life.

In respect to the more general hypothesis, it was found that, contrary to clinical evidence indicating that this is a difficult time of life for parents, a large majority of the parents studied defined postparental life favorably, especially in terms of the many new freedoms at their disposal now that they no longer had responsibility for their children.

Microfilm $3.30; Xerox $11.20. 255 pages.

THE EFFECTS OF A GROUP OF NON-INSTITUTIONALIZED MONGOLOID CHILDREN UPON THEIR FAMILIES AS PERCEIVED BY THEIR MOTHERS

(L. C. Card No. Mic 59-2082)

Howard R. Kelman, Ph.D.
New York University, 1959

This study was designed to investigate the reported effects upon family living of a group of mongoloid children residing at home. In addition to examining the perceived impact of the child upon the family, the families' reactions to the event were analyzed.

Most authorities consider that the presence of the mongoloid child in the home is uniformly damaging to the family and its members. Other experts suggest that the child's presence in the home need not necessarily exert a harmful influence upon all families. While opinion is sharply divided on this question, little attention has been given to the question of variability of family reaction to the child, and to variations in impact associated with the passage of time.

Twenty families of mongoloid children, who were known to a special clinic for retarded children, comprised the experimental group. A control group, consisting of families of non-defective children known to two non-sectarian community centers, was utilized to differentiate the effects of

normal children upon their families from those associated with mongoloid children. The two groups of families resided in New York City and were intact units with the child living at home. Families were individually matched for significant variables related to the status of the child and the family.

Successive pairs of mothers of both groups were individually interviewed employing a five-part interview and maternal attitude scale. The exact responses of the subjects were recorded and constitute the data analyzed in the present study.

Comparisons between the two groups were made of current patterns of functioning in eight areas of family living for measures of social withdrawal, disruption in routines and planning and interpersonal alienation. The nature and degree of alterations reported in these areas of living for two time periods were also analyzed. Selected maternal attitudes as well as other measures of family structure and functioning were compared for the two groups. Additional data secured from the experimental group families analyzed the theories of causality and reactions of family members to the fact of having a mongoloid child.

The results revealed statistically significant differences favoring the control group, differences favoring the experimental group and similarities between the two groups in all areas of family living investigated. No consistent differences were obtained with respect to the nature or degree of alterations in family living reported. Statistically significant differences in maternal attitudes were not demonstrated except for the attitude "Comradeship and Sharing" which favored the experimental group.

It was determined that the interval of time which is most deleterious for families of mongoloid children is that period following the birth of the child up to two years of age. The results of this study also indicate that the presence of the mongoloid child in the home evokes differential reactions and responses from families despite common elements in the situation that confront them.

The general conclusion of this study is that the presence of the mongoloid child in the home need not necessarily prove to have a uniformly damaging effect upon family living and may produce certain beneficial consequences for some families. The data also suggest that the negative predictions concerning the uniformly harmful effects of mongoloid children upon their families may arise, in part, out of observations made of families seen during the most stressful period of their reaction to the problem. The fact of having a mongoloid child does not obliterate differences between families in terms of their functioning, values and goals, and does not offer a sufficient basis for categorizing families for purposes of parental counselling or guidance. Microfilm $3.55; Xerox $12.20. 276 pages.

PARENTAL PARTICIPATION IN CHILD-REARING AS EVALUATED BY MALE SOCIAL DEVIATES

(L. C. Card No. Mic 59-2702)

Paul S. Ullman, Ph.D.
University of Oregon, 1959

Adviser: Theodore B. Johannis, Jr.

The purpose of this study was to discover the extent to which maternal overparticipation and paternal underparticipation in child-rearing are related to deviant sexual behavior by adult male social deviates.

Parental overparticipation in child-rearing was defined as excessive interaction initiated by the parent in direct relationship with the child. Conversely, underparticipation was defined as inadequate interaction initiated by the parent in direct relationship with the child. Child-rearing behavior was broken down into two major areas: maintenance and training behavior. Maintenance behavior refers to activity by the parent directed at satisfying the child's physical, social, and emotional needs. Training behavior involves activity by the parent directed at creating response patterns of self-maintenance in the child. The parent educates and disciplines the child in order to bring about behavior that will enable him to function independently of parental care. Over and underparticipation by the parents in both these areas is believed to lead to behavioral problems in the child and adult social deviancy. The belief is reflected in such concepts as "overprotection," "rejection," and the like, which are frequently found in the child-rearing literature.

In this study an experimental group of 325 social deviates whose past histories as adults included instances of deviant sexual behavior were compared with a control group of 311 social deviates whose histories did not show any deviant sexual behavior. The participants were all inmates at the California Medical Facility, a state prison-hospital in Vacaville, California. The comparisons were effected through the use of a questionnaire which recorded the respondent's evaluations of the amount of parental participation in various areas of socialization related to maintenance and training behavior. The Chi Square test was used to determine if significant differences existed between the groups. Additional data on personal and family background factors were also collected for descriptive and comparative purposes. The experimental group was then broken down into four groups consisting of 92 sex psychopaths, 101 homosexuals, 68 pedophiliacs, and 52 rapists. Each of these groups was compared with the control group on the same variables pertaining to parental participation.

The results showed that, with the exception of the homosexuals, there was no difference in the reported amount of parental over and underparticipation between the experimental and control groups. The homosexuals had a marked tendency to report maternal overparticipation in training behavior and paternal underparticipation in maintenance behavior.

The study indicates a need for further research on the theoretical issue of whether particular patterns of child-rearing by parents are likely to produce particular kinds of deviancy by the child.

Microfilm $2.20; Xerox $7.80. 167 pages.

SELECTION OF FOSTER PARENTS: EARLY STAGES IN THE DEVELOPMENT OF A SCREEN

(L. C. Card No. Mic 59-2605)

Martin Wolins, D.S.W.
Columbia University, 1959

Foster care of children is an important social institution. Annually, thousands of homes are selected by social agencies and thousands of children placed and re-placed. The process of selecting homes has evolved gradually over the past century. At present there seems to be considerable agreement on what constitutes a good foster home and what procedures a social agency should follow in order to assure the selection of satisfactory homes for the children in its care. However, to do so agencies must have a continuous supply of applicants which substantially exceeds the demand for homes.

It should be possible to increase the number of applicants if it were known how to discriminate easily between acceptable and unacceptable homes, and if it were known what incentives the acceptable families require in order to join the program.

The present research is a first step in an attempt to develop a screen which would duplicate the decision of the foster home finder. In order to develop such a screen it is necessary to establish whether and under what conditions workers' decisions are reliable. To obtain this information workers involved in foster home finding and in placement of children were asked to make decisions about written home study cases. The case materials were systematically varied as to content and volume and these were related to the reliability of decisions obtained. The research has shown that reliability is related to the experience of the judge in making foster home finding decisions, and to the content and volume of the materials upon which judgment is based. Reliability is high for experienced judges. It is also high when volume is not too great and the content selected for relevance.

Accepting an assumption that validity in the present research is measured by the extent to which decisions correlate with those based on full case records, the following types of information about families are found to be used:

1. Goal orientation.
2. Self-image.
3. Role perception and enactment.
4. Cohesion of the family unit.
5. Reciprocity and flexibility.

A screen can now be developed from these five types of items. Such a screen may be expected to discriminate between accepted and rejected foster family applicants.

Microfilm $2.00; Xerox $7.00. 149 pages.

SOCIOLOGY, PUBLIC WELFARE

THE RELATION OF SOCIAL CLASS MEMBERSHIP TO OPINIONS REGARDING WELFARE SERVICES AND RECIPIENTS

(L. C. Card No. Mic 59-1762)

Travis J. Northcutt, Jr., Ph.D.
The Florida State University, 1959

The purpose of this study was to determine whether opinions regarding welfare services and welfare recipients were independent of position in the social class hierarchy. The study was conducted in an agricultural service-vice-station town believed to be representative of the South Georgia-North Florida sub-region. The study was part of a larger project investigating variations in opinions regarding health, mental illness, welfare, roles of working wives, child-rearing practices, recreation, and family planning.

The null hypotheses were grouped under two headings: (a) welfare services and (b) the recipients of welfare. Thirty hypotheses were used to learn the opinions of ever-married homemakers in a 20 per cent random sample of the community's white households. The McGuire-White Index of Social Status-Short Form was used to assign positions in the social class hierarchy. The statistical model for determining dependence of the variables was Chi square.

Dependence of the variables was found for only 13 of the 30 items, and social class was therefore not uniformly related to opinions. It was found, however, that in general the community saw the need for Federal and state support of welfare programs, that it viewed financially-secure citizens as having a responsibility for welfare, and that the religious agencies of the community were seen as having an important "charity" role.

In general, too, it was found that members of the upper social classes were more stringent in their opinions regarding permissible relief expenditures. In contrast, members of the lower social classes held more favorable opinions regarding recipients of welfare.

The study found that the respondents had little knowledge of the local welfare department--despite its existence for 20 years--and that criteria used in judging its effectiveness were rarely based upon factural knowledge.

Microfilm $2.00; Xerox $5.00. 100 pages.

SOCIOLOGY, RACE QUESTION

THE BRITISH POLICY OF PARTNERSHIP IN THE FEDERATION OF RHODESIA AND NYASALAND

(L. C. Card No. Mic 59-2664)

Robert Ralph Griswold, D.S.S.
Syracuse University, 1959

It is the purpose of this 278 page dissertation to examine the nature of multi-racial "Partnership" as it has

been defined, and is being implemented by the British Government, and by the Federal and the territorial Governments in the Federation of Rhodesia and Nyasaland during the Federation's first four years (1953--1957).

The paper is divided into seven chapters, the first of which traces the history of the British in Central Africa, and gives a brief survey of the economic and political structure of the Federation.

Chapter II explores the meaning of partnership from the viewpoint of the four governments, the white settlers of Central Africa, and the African peoples. This chapter not only attempts to define "partnership," but it also explains why the policy has been adopted by the British Government.

Chapters III through VI examine the actual implementation of the policy in the social, economic, political, and educational spheres respectively.

The chapter on social partnership is concerned with the colour-bar, and the difficulties of over-coming prejudice and intolerance that is deep-rooted because of the almost unbridgeable cultural gap that exists between the European and the African peoples.

The economic partnership chapter is a detailed case study of the strikes on the Copperbelt of Northern Rhodesia which occurred in 1954--1957 over the question of the advancement of the Africans into jobs held by Europeans.

The chapter on political partnership is concerned mainly with the emergent nationalism of the Africans of Northern Rhodesia and Nyasaland, and with the political activity of the African National Congress. Another area explored by this chapter is that of the extension of the Federal franchise to the Africans in the winter of 1957--1958. A close examination of the functions of the African Affairs Board is undertaken in this connection.

The chapter on the implementation of partnership in the educational sphere outlines the problems of, and the progress made in, educating the Africans on the primary, secondary, trade, university, and extension levels.

The final chapter of the paper recapitulates the conclusions of the preceding chapters, and looks to the future. The general conclusions are as follows:

1. Partnership has never been clearly defined to the satisfaction of Europeans and Africans alike.
2. Multi-racial cooperation is a necessity if Central Africa and all its peoples are to prosper.
3. The timetable for the realization of partnership is a most difficult problem. The impatience of African nationalism may not wait for the maturity which Europeans want before full partnership is realized.
4. The ultimate solution must come out of Central Africa itself, and not be imposed from outside.
5. To a limited extent the colour-bar has been breached; the door has been opened to African advancement on the Copperbelt; the franchise has been widened to encompass formerly unqualified "protected persons," and persons of lesser educational and means qualifications; and educational opportunity is being made available to all Africans as teachers and facilities permit. That this progress along the road to partnership for the African is widely accepted, or will go much beyond the point already reached, is open to question.
6. There are strong forces within and without the Federation which militate against the maturing of the partnership concept.
7. The bridging of the cultural gap and of the wealth differential through education offers the most likely solution, but this takes time--which may not be available.
8. If partnership fails, extreme social domination by one or the other major races will inevitably result.

The dissertation was written primarily from official Colonial Office reports, and from the files of East Africa and Rhodesia.

Microfilm $3.85; Xerox $13.00. 298 pages.

SPEECH-THEATER

JOHN G. NEIHARDT AS SPEAKER AND READER

(L. C. Card No. Mic 59-2620)

Lucile Folse Aly, Ph.D.
University of Missouri, 1959

Supervisor: Loren D. Reid

John G. Neihardt, epic poet best known for his Cycle of the West, attained distinction in two careers besides the writing of poetry. He thought of himself chiefly as a poet and focused his energies on the writing of his epic; nevertheless, he established a reputation as literary critic and as platform speaker and reader. In his two subsidiary careers he found avenues of communication for the thesis he sought to develop in all his work: men must seek values not only on the lower levels of brute existence but on the higher levels of human understanding if they were to live decently together.

Neihardt's preparation for a speaking career was unconventional. Although he was largely untrained in the academic sense, avid reading and breadth of interests gave him a vast store of information, and his retentive memory enabled him to assimilate and use it. The influence of Hindu philosophy in his early reading encouraged his tendency toward mysticism. Experiences in his youth and in his writing confirmed him in his belief that he was assisted by a power outside himself, that concentration to the point of losing himself in a worthy enterprise enabled him to tap a "higher awareness."

Neihardt entered upon a career as speaker and reader only because he needed money. His first appearances were ordeals, but the enthusiasm of audiences encouraged him to accept further engagements. In time he conquered

his apprehensions and developed confidence in his ability to establish rapport with audiences. His rhetorical theory evolved from practice, not from reading; he gradually lost his self-consciousness in strong feelings of affection for his hearers. Lecture engagements ceased to be irksome and eventually became a pleasure.

Although Neihardt had received almost no formal training as a speaker, his conscientious approach to speaking problems taught him sound principles of persuasion. Recognizing the importance of adapting ideas and procedures to specific audiences, he learned the value of logical, emotional, and ethical proof and used all three types of persuasion with skill. He spoke chiefly on literary subjects and on western history and culture. His intimate acquaintance with Omaha and Sioux Indians, as well as his extensive research in preparation for the writing of his Songs provided him with a fund of stories and illustrations. The lectures on Black Elk, Sioux holy man, and on the background of the Cycle proved immensely popular, as did the lectures on contemporary literature and on poetic values. These lectures were rhetorically interesting for Neihardt's original approach to the defense of poetry. Departing from the conventional arguments of literary critics, he moved the case into the sphere of probability.

In his early years of speaking Neihardt prepared manuscripts with great care. As he gained experience he abandoned this practice and depended upon clear organization, with amplifying details drawn from his general knowledge. Sometimes he made notes but often did not use them in the actual presentation. His manner in the delivery of speeches was unaffected but energetic. His striking appearance, clear, resonant voice, and force of personality proved effective; audiences were moved and inspired by his performances.

As a reader Neihardt learned techniques of interpretation by experience. Aided by his natural feeling for sound and rhythm, he mastered skills that enabled him to recreate his poetry for audiences approximately as he had conceived it.

After Neihardt had finished his Cycle and closed his active service as literary critic, his three careers merged in a new enterprise: Poet in Residence and Lecturer in English at the University of Missouri. By lecturing and teaching his poetry, Neihardt brought inspiration to hundreds of students.

Microfilm $5.00; Xerox $16.80. 391 pages.

THE NATIONAL ASSOCIATION FOR THE ADVANCEMENT OF COLORED PEOPLE AND THE AMERICAN THEATRE: A STUDY OF RELATIONSHIPS AND INFLUENCES. (VOLUMES I AND II).

(L. C. Card No. Mic 59-2728)

Leonard Courtney Archer, Ph.D.
The Ohio State University, 1959

This study of the relationships of the NAACP with the American theatre was inspired by the Association's prominence in Negro leadership and by its successful plea before the United States Supreme Court in 1954 for desegregation in public education. Many informed persons know of the NAACP's programs and actions in pursuit of legal, economic, political, and educational equality for Negroes, but comparatively few informed persons are fully aware of the NAACP's relationships with the commercial and noncommercial theatrical activities in America.

From the founding of the NAACP in 1910 to the present, this Association's programs have been related to many phases of Negro life, including the legitimate theatre, the motion picture and the broadcasting industries. In these phases of the American theatre, study revealed that the NAACP has conducted protest campaigns against racial segregation and discrimination. This study attempted to determine the effects of the Association's protests upon performers, actors, and theatrical productions. The NAACP desired esthetic equality in theatrical entertainment and sought more favorable representations of Negro life by protesting against Negro stereotypes in literature, on the stage, and in the motion picture and broadcasting industries. There has been an attempt in this investigation to evaluate these protest campaigns with reference to the general motives of the NAACP's national programs.

The internal national programs of the NAACP have been directed toward the cultural and social uplift of the Negro people, toward race pride and group identification, and toward mass action. One phase of the NAACP's program has been in the direction of the noncommercial theatre. An effort has been made to determine the extent and effect of the NAACP's relationships with the noncommercial theatre.

For this determination many sources were studied, chief of which were The Crisis, the official monthly publication of the Association, and The Pittsburgh Courier, one of the leading Negro newspapers. Books and studies related to the several areas of this study were also used: The Negro's Morale, Arnold M. Rose; A Man Called White, Walter White; One Hundred Years of the Negro in Show Business, Tom Fletcher; The Patterns of Segregation, Charles H. Johnson; The Negro in Films, Peter Noble; The Age of Television, Leo Bogart; and Art and the Color Line, Anson Phelps. Additional material for documentation came from periodicals, newspapers, pamphlets, letters, statements, and personal interviews.

An evaluation of the relationships of the NAACP to the American theatre has led to the following conclusions: First, advancement of the Negro performer has come as a result of the advancement of the Negro in American life, of the esthetic needs of the theatre, and of the attitudes of producers. Second, the NAACP's protest campaigns against racial stereotypes in theatrical productions succeeded in helping Negro performers and actors to gain better roles, but failed in helping to provide more economic opportunities for Negro performers. Third, the NAACP's protest campaign against racial segregation and discrimination succeeded in helping to change the policies of a number of theatres in favor of accepting Negroes in the audience and on the stage. Fourth, the relationships of the NAACP with the noncommercial theatre were not direct and enduring enough to be significant. Finally, in the opinion of the author, the NAACP should refrain from theatrical censorship and protests against stereotypes because these actions have brought about a confusion of motives which have reduced the economic opportunities of Negro performers.

Microfilm $7.20; Xerox $24.80. 566 pages.

THE PREACHING OF WILLIAM FRANKLIN GRAHAM

(L. C. Card No. Mic 59-2834)

John Edward Baird, Ph.D.
Columbia University, 1959

This study proposes to investigate the nature of the preaching of the mass evangelist by comparing the preaching of William Franklin Graham, outstanding mass evangelist of the mid-twentieth century, with the instructions for the pastor-preacher found in the textbooks on homiletics.

While Graham's education has fallen short of the ideal, the various experiences and relationships of his life have given him the ability to appreciate other viewpoints and to make himself appealing to others. In most respects he has overcome the deficiencies of his formal education. Physically, mentally, socially, and morally, he is the ideal preacher described in the textbooks. However, his thinking has been conditioned by his success as an evangelist and by the tradition of revivalism in which he stands. He does not really grasp the concept of a preacher functioning within the Church, and he limits his ministry to the motivation of individual conversions.

The comparison of the setting in which the mass evangelist preaches with the church service indicates that they differ little in their essential nature. The Graham organization conducts a service which, in general, closely approximates the church service. The evangelistic service differs by emphasizing the evangelist as a unique personality.

The analysis of the audience of the twentieth century demonstrates the extent to which Graham's preaching coincides with the suggestions of the writers. The evangelist appeals to the very conditions and patterns of thinking which the writers suggest are present in the audience of the day. The evangelist makes every attempt to attract all people to his services. However, his success is very limited, for no evidence was found of a significant difference between the crusade audience and the church audience.

The content of Graham's sermons differs from the precepts of the writers in its emphasis on judgment and in a failure to grasp the full social significance of sin. Graham's fundamentalism also serves to limit the biblical authority of his preaching, and his objective in speaking is limited to producing initial decisions for Christ.

Other aspects of Graham's sermons exhibit few differences from the writers' instructions. However, he sometimes uses ethical persuasion so powerfully that he has been accused of being manipulative in his treatment of the audience.

In sermon delivery, Graham can almost serve as a model to exemplify the teachings of the writers. The evangelist prepares his sermons carefully and delivers them extemporaneously. Such elements as projection and contact, pronunciation and articulation, rhythm, voice, and bodily activity are generally in accord with the instructions of the textbooks.

The comparison of the preaching of Billy Graham with the precepts of the writers serves to identify many areas of agreement. In other areas the differences cannot be regarded as significant. The areas of real disagreement serve to support the following conclusions:

(1) The preaching of the mass evangelist differs from that of the pastor-preacher in that it limits itself to the conversion of the individual.

(2) The preaching of the mass evangelist differs from that of the pastor-preacher in that it limits itself to the individual's relationship to his God.

(3) The preaching of the mass evangelist differs from that of the pastor-preacher in that it concentrates the persuasive effect of the preacher's personality in a brief span of time in the actual speech situation.

These conclusions furnish a basis for further research, assist in the evaluation of individual preachers, and offer a guide in the education of the future minister.

Microfilm $4.95; Xerox $16.60. 386 pages.

A PHONETIC APPROACH TO THE RELATIVE INTELLIGIBILITY AND ERROR RESPONSES AMONG INITIAL CONSONANTS AND CONSONANTAL CLUSTERS

(L. C. Card No. Mic 59-2729)

Elizabeth Sarah Bell, Ph.D.
The Ohio State University, 1959

The present study was an investigation of the relative intelligibility and error responses of initial consonants and of clusters of the same consonants.

An assumption underlying the study was that the intelligibility of a word relates systematically to the intelligibility of the component phonemes. The intelligibility of words was compared with the combined intelligibility (joint probability) of portions of the words; similarly, the intelligibility of consonantal clusters was compared with the product of the intelligibility values of the member phonemes. In preparation for this latter comparison the intelligibility of the initial clusters and components of clusters of 1,629 monosyllabic words was determined. The words were from two lists of words that had been previously responded to by listeners in intelligibility testing. Throughout the study independent and parallel determinations were made on the basis of the two independent samples of words: List I and List II.

Two main approaches were used in this study. The first was statistical and compared the relative intelligibility values of consonantal clusters and of the members phonemes of these clusters. The second was qualitative and categorized the particular errors made in listening to consonantal clusters and to the member phonemes of these clusters. The phonetic errors among the responses to consonantal clusters and to member phonemes of these clusters were tabulated in a response matrix, an arrangement of rows and columns, with the headings of categories of the stimuli occurring also as the headings of categories of responses. List I and List II were again treated separately in the matrix.

Two sets of intelligibility values of phonemes were obtained: (1) intelligibility values that were derived from separate words beginning with single consonantal phonemes and (2) intelligibility values of the same phonemes that were determined from the intelligibility of the clusters containing the consonants.

A systematic relationship was found between clusters

and the components of the clusters. Ratios were computed between the relative intelligibility of each cluster and the joint probability of the component phonemes. The obtained ratios of each list of words were applied as correction factors to the joint probabilities of the other list. Rank order correlations between these "corrected" joint probability values of pairs of consonants and obtained intelligibility of the clusters indicated a consistency in the relative intelligibility of consonants and consonantal clusters.

The intelligibility of clusters was found to be more closely related to the intelligibility of the first component than of the second component.

Semantic components (components forming a meaningful word within another word) seemed neither to affect the intelligibility of the word that included a second word nor to relate to the intelligibility of the same groups of sounds when a separate word.

An initial cluster and a single consonant are not readily confused. As a rule, words beginning with clusters were heard as words beginning with either the correct of incorrect clusters and words beginning with single sounds were heard as beginning with either correct or incorrect single sounds. The most frequent errors, that is, wrong words, either preserved the correct initial sound or substituted a similar one, voiced or voiceless as the case may be.

The procedures and outcomes of this study may help to answer the query, Is a consonantal cluster a joint event of two successive phonemes or a singular phonetic unit? On the basis of the relationship between the intelligibility of the clusters of one list and the joint probability (intelligibility) of the consonants of the other list, the cluster bore a positive and consistent relationship to the joint event of its successive sounds. This relationship was the stronger between the cluster and the first phoneme than between the cluster and the second phoneme.

Microfilm $2.00; Xerox $6.40. 133 pages.

QUEEN CITY STAGES: PROFESSIONAL DRAMATIC ACTIVITY IN CINCINNATI, 1837-1861

(L. C. Card No. Mic 59-2558)

James Francis Dunlap, Ph.D.
The Ohio State University, 1954

The present study deals with plays and other dramatic entertainments produced in Cincinnati from 1837, when the National Theatre opened, to 1861, when the Civil War began and an era of theatre ended. The former year was chosen as a beginning point because the National, a theatre which dominated dramatic life in Cincinnati for the ensuing twenty-two years, began its career in 1837.

The intensive field of study is of the years 1845-1861, a golden age in Cincinnati theatre history. A complete chronological listing of dramatic entertainments produced in all Cincinnati playhouses in operation during that period is included in the dissertation.

The writer's task was (a) to assemble and analyze bills of plays and their accompanying entertainments, previously uncollected, which were given in an important city on what was then America's western frontier, (b) to study theatre against a background of the era in the whole life of Cincinnati, and (c) to present evidence, found within bills of plays produced, of native works which have long been lost or whose earlier performance dates have not been known.

Contemporary Cincinnati newspapers were used as a major primary source of material. Nearly complete files of the three dominant newspapers of the era (The Cincinnati Enquirer, The Cincinnati Daily Commercial, and The Cincinnati Daily Gazette) were found in the libraries of the Ohio Historical and Philosophical Society, in Cincinnati, and the Ohio State Archaeological and Historical Society, in Columbus. Contemporary theatre programs, together with the Alvin A. Read Collection of playbooks (used by Mr. Read, a well-known Cincinnati actor during the years 1857-1861), also housed in the Ohio Historical and Philosophical Society library, were of great value in their individual respects. The scope of the immediate study was limited to dramatic entertainments, though the whole field of theatre for the period was, of necessity, included in the research.

The years 1845-1861, which represent the core of the study, have been separated into three segments. The first, 1845-1850, covers a period when Cincinnati theatres were making adjustments and gaining in momentum in a manner simultaneously experienced by the Queen City itself. The second, 1851-1858, and the third, 1859-1861, are the years both of most extensive dramatic activity and significance in the city's theatrical history. The latter years have been considered separately because they reveal the effects of unsettled national conditions on theatre in Cincinnati, as well as the emergence of the "sensation play" and the initial appearance of new theatre practices (the "star company" and concerted effort in play production) which so effectively changed the course of theatre during the last decades of the 19th century. In its entirety, the period gives an excellent picture of the early and varied departures taken by theatre in moving from an old order Romanticism, to what ultimately became a strong new one, Realism.

Entertainments covered by the study are defined as follows: plays, music dramas, ballets, pantomimes, and minstrel shows, when produced in established theatres under the aegis of managers, either by stock companies alone or augmented by visiting stars or troupes of entertainers. These general types have been subdivided into categories in order to facilitate the handling, for any purposes of analysis, of nearly 1600 individually titled dramatic entertainments. The ten categories selected are melodrama, farce, melodramatic spectacle, classic, comedy, tragedy, music drama, burlesque, pantomime, and ballet. The latter two forms of dramatic entertainment are relative to the study only as they appeared as supplementary diversions on an evening's bill, and are included only in statistics covering total number of performances.

The 19th century habit of indiscriminately calling a play a musical farce in one bill and a comedy drama in another was one determining factor which caused the writer to organize the above categories, rather than use the original designations. While the utilization of these varied and often ambiguous terms was not feasible, it was possible to apply two play forms familiar today which were also the foundation of much 19th century drama: melodrama and farce. All play classification in the study stems from these two dramatic genres.

The guide in categorizing the plays, most particularly

in the case of comedies, tragedies, and music dramas, has been contemporary attitudes toward play types, i.e., what 19th century audiences thought they were seeing, as opposed to 20th century judgments of the plays. The importance of "the legitimate" drama to theatre of the time led to the inclusion of a category for such plays. The term "classic play" has been used to designate works by playwrights most active before 1800, plays which were highly regarded as "legitimate," in contrast to contemporary dramas.

Table I shows the total number of plays, separated into the categories mentioned above, which were acted in Cincinnati theatres during the period encompassed by the study. Table II lists titles of the three most popular plays in each category, together with the one ballet and pantomime most frequently performed, and gives a clear indication of the kaleidoscopic theatrical tastes of the era. In connection with Table II, it is important to note that Camille and the plays of Boucicault, works which extensively influenced later play writing, came near the end of the period. While these dramas were exceedingly popular with Cincinnati audiences, Table II does not disclose that fact.

TABLE I
Total Number of Dramatic Entertainments
by Category, Performed in Cincinnati Theatres, 1845-1861

Category	Number
Melodrama	530
Farce	518
Melodramatic Spectacle	132
Classic	71
Comedy	94
Tragedy	34
Burlesque	34
Music Drama	53
Ballet	73
Pantomime	59
Total	1598

TABLE II
The Most Popular Dramatic Entertainments,
by Category, Performed in Cincinnati Theatres, 1845-1861

Category	Title	Performances
Melodrama	The Lady of Lyons	157
	The Hunchback	95
	Black-Eyed Susan	85
Farce	A Loan of a Lover	95
	A Glance at New York	90
	Perfection	89
Melodramatic Spectacle	Uncle Tom's Cabin	123
	The French Spy	96
	Aladdin	71
Classic	Hamlet	141
	Richard III	139
	Macbeth	107
Comedy	Faint Heart Never Won Fair Lady	75
	The Honey Moon	69
	The Serious Family	62
Tragedy	Fazio; or, The Italian Wife	59
	Virginius	43
	Damon & Pythias	39
Burlesque	Po-ca-hon-tas	43
	The Lady of the Lions	31
	Antony & Cleopatra	14
Music Drama	Cinderella	52
	Guy Mannering	50
	Rob Roy	40
Ballet	Giselle; or, Les Willis	22
Pantomime	The Green Monster	25

FINDINGS: A total of 216 plays, advertised in newspapers or subsequently referred to in editorial columns as having been produced, comprise a group of dramas which have not been found on any previous listing of American plays. A portion of these plays was the work of Cincinnati playwrights. Others, through editorial references to subject matter or character names found in playbills, are of anonymous, but certainly American origin.

Cincinnati theatre in the years 1845-1861 was distinguished for the number and variety of dramatic entertainments given, the number of theatres open (one for the entire period, five others for varying lengths of time, and three simultaneously during 1850-1851, and 1859-1861), the number of famous actors who played engagements in Cincinnati theatres, the support and coverage given to playhouses by the press, and the continuous operation of the National Theatre under one management.

There was active opposition to theatre throughout the period. In spite of such, the playhouse became an integral part of community life. In theory, theatre was to present the best of drama to its audiences. In practice, this idealistic precept was defeated by two forces: indiscriminating tastes and a fondness for novelty in stage offerings on the part of audiences, and the poor quality of plays written by contemporary playwrights.

1845-1850: The city and theatre were both growing rapidly, and the playhouse made an important progressive step by being recognized as a permanent institution in Cincinnati. In general, dramatic entertainments were quietly conventional, not much influenced by contemporary theatre practices elsewhere, but depending on plays which were old and established favorites from a previous era. Even in this early period, the press gave good coverage to theatre, though editors, like audiences, were naive and simple in their tastes and criticisms.

1851-1858: This was the period of most extensive activity. More plays were produced. Spectacles became popular, and increasingly elaborate. Greater dexterity was developed in the handling of stage machinery and effects. Editors became more discerning in their comments on theatre. Toward the end of the period, a new

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

concept of play writing was noted. Tinges of realism appeared, with a shortened perspective which permitted a closer view of life as it was. The old sentimental drama was not completely neglected, however, but was noticeably less prominent at this time. In 1858, sharp negative criticism of the morals and influence of theatre arose.

1859-1861: Radical changes appeared in the old melodrama. Its poetic language was clipped, its lines shortened. There was a new emphasis upon action. The introduction of "sensation plays" (many of them dramatizations of New York Ledger stories), with a more rapid pace than that present in earlier melodramas, reflected the changing times. At the end of the period, unsettled political and financial affairs, both local and national, affected theatre. Attendance lagged. Interest lessened. During the months immediately following the firing upon Fort Sumter, theatres opened and closed briefly. By July, 1861, Cincinnatians had no dramatic entertainment to divert them from the war.

The era covered by the study shows development from a theatre which reflected the simple, indiscriminating tastes of its audiences to one whose patrons were beginning to appreciate comedies of social satire as well as the more realistically written plays. The period significantly points toward the path taken by theatre in the later years of the century. Microfilm $3.85; Xerox $13.00. 299 pages.

Abstract published by special arrangement with The Ohio State University.

THE POLITICIAN ON THE AMERICAN STAGE, FROM 1870 TO 1915

(L. C. Card No. Mic 59-1943)

Mortimer L. Fisch, Ph.D.
New York University, 1959

The purpose of the study, The Politician on the American Stage, 1870-1915, was to trace the development, and possible change of the character of the politician as portrayed on the New York stage during this period and to compare and contrast the characteristics and actions of these stage politicians with those of their real-life counterparts.

The study involved an analysis of plays dealing with politics and politicians of the period 1870 to 1915; the reaction of the professional reviewer and critic to these plays; a consideration of the characteristics and political activities of representative political figures of the period; and an analysis of the dramatists' representation of the politician.

The plays were located through compilations, such as T. Allston Brown's A History of the New York Stage, 1783-1901; Burns Mantle and Garrison P. Sherwood's Best Plays of 1899-1909 and Best Plays of 1909-1919; and George C. D. Odell's Annals of the New York Stage, Vols. IX-XV; and publications, such as The New York Dramatic Mirror. Critical reviews were obtained, in the main, from The New York Dramatic Mirror, The New York Times, The New York Herald, The New York Post, The New York Tribune, and Theatre Magazine. Plays no longer extant in either manuscipt or printed copy were discussed on the basis of plot outlines in contemporary newspapers and periodicals. Manuscripts and printed copies were obtained at the New York Public Library, the Library of Congress, the University of Pennsylvania Library, The Harvard University Library, and the Yale University Library.

An analysis of each of the three periods, 1870-1890, 1890-1902, 1902-1915, into which the study is divided, was made with especial regard to political activities of the time, outstanding or scandalous political figures of the time, and movements or issues which may have influenced these. The plays were studied for their portrayals of political figures and possible relationships between these stage politicians and their real-life counterparts. Frequently aiding in this were the reviews by dramatic critics in periodicals of the time. The stage politician was analyzed particularly with regard to dominant characteristics and possible change and development, especially during periods of reform or scandal.

In the main, the study revealed a growing responsiveness of dramatists to political figures and affairs and a gradual tendency on the part of these dramatists to change portrayals of stage politicians from comic rogues and scamps to more realistic representations of contemporary political figures. In the early portion of the study, 1870-1890, few, if any, of the plays appear to have been inspired by major political issues or specific political figures. However, with the Populist revolt in 1890, some playwrights saw dramatic possibilities in politics and politicians. Not only did more plays dealing with politics and political figures appear during the period 1890-1902 but some of these were serious efforts inspired by real politicians and actual political occurrences. Twenty of sixty-two political figures discussed during this period were possibly based upon real-life politicians who were involved in the public life of the day. In the final period of the study, 1902-1915, the influences of the Progressive Movement and the "muckrakers" were distinctly evident. Not only were actual politicians represented on the stage but connections with big business and vice were represented as well. The majority of the plays discussed were serious attempts to represent the political picture of the day. Of one hundred twelve politicians featured in these plays, sixty-two were serious pictures of corrupt political figures. And of these one hundred twelve figures, possibly' thirty-eight stage politicians were based on real politicians of the day. Microfilm $3.80; Xerox $12.80. 294 pages.

CONCEPTS OF DRAMATURGICAL TECHNIQUE AS DEVELOPED IN TELEVISION ADAPTATIONS OF STAGE PLAYS

(L. C. Card No. Mic 59-2847)

Robert L. Hilliard, Ph.D.
Columbia University, 1959

The purpose of this study is to analyze live television adaptations of selected stage plays[1] from 1939 through 1956 in order to provide (a) a guide for the analysis of television plays, (b) techniques for the adaptation of stage

plays to television, and (c) developing concepts of dramaturgical technique.

Investigation of the special characteristics of television provides bases for the analysis of adaptations. The time element necessitates drastic reduction of the original play. Space limitations of the studio and of the television screen limit the settings and the amount of subject matter that can be presented at any one time. The television audience is less sophisticated and less selective than is the theatre audience, and does not react as a mass, but as small family groups in an atmosphere which is subject to the everyday distractions of the home. Subject matter from the stage is often deemed unsuitable for television and is frequently regarded as censorable (in bad taste), topical (dated), or controversial (capable of disturbing the beliefs of the viewer or advertiser). The mechanical and electronic devices of television create a fluidity of time and of place and help to direct the attention of the audience to intimate objects and actions.

Investigation of the background of dramaturgical theory from Aristotle to the present day provides further bases for the analysis of scripts. Modern concepts of dramaturgy relate to unity, plot, character, dialogue, exposition, preparation, and setting.

Individual analyses of each adaptation, comparative analyses of all adaptations of each selected stage play, and a synthesis of all of the analyses, according to the characteristics of television and the concepts of dramaturgical technique, provide conclusions concerning the adaptation of stage plays to television, and indicate developing concepts of dramaturgical technique basic to live television.

The conclusions indicate that the greatest problem is that of time, and that the adaptation must have no irrelevancies, few characters, and one plot line. The limitations of settings, of outdoor effects, and of the number of characters on the screen at one time similarly contribute to an emphasis on the intimate, "slice-of-life" play. Censorship of subject matter restricts the adapter and harms the play. Mechanical and electronic devices permit a concentration on the intimate representational approach and on the presentational audience-performer relationship. The unity of impression of the television play must be complete and consistent. The medium permits many scenes and many changes of time and of place. The plot structure of the television drama is similar to that of the stage play except that time and space restrictions require early presentation of the conflict, a condensed and simplified plot line, no sub-plots, few complications, and, usually, no resolution. The special characteristics of television permit the presentation of the intimate actions and inner characterizations of the protagonists. Although plot is the primary motivating factor in the television drama, character is gradually re-emerging as a focal point. The visual element may sometimes be substituted for dialogue. Lack of time frequently prevents the early and adequate presentation of exposition on television. Electronic and mechanical devices and the retention of each important plot sequence from the original play contribute to subtle presentation of exposition and to effective presentation of preparation. New preparatory material is sometimes necessary to validate revisions made in the original script. The fluidity of television permits the use of many small or moderate-sized settings, and the frequent re-use of existing settings. Microfilm $3.40; Xerox $11.60. 264 pages.

1. The selected stage plays are Stage Door, Prologue to Glory, and Our Town.

SOME BASIC SPECIFIC PROBLEMS OF STAGING THE PLAY IN THE COLLEGE AND UNIVERSITY THEATRE

(L. C. Card No. Mic 59-2720)

Eugene Quinter Hoak, Ph.D.
The Ohio State University, 1954

The staging of full-length plays in the rank and file of American colleges and universities poses several persistent problems for the director-designer. His problems fall into three categories: (1) administrative policy which governs dramatic production on the campuses, (2) the preparation, collaboration, and practices of the personnel charged with the actual designing and staging of plays, and (3) the limitations of the actual theatre stages and their basic equipment. The data gathered in a survey of 30 college and university drama-producing organizations showed that these three categories embraced all of the basic problems of staging plays in the schools.

One purpose of the study was to determine the actual existence, the scope, and the degree of severity of the problem. By way of a carefully prepared questionnaire dealing with the three phases of production named above, I was able to record the number, kind, and quality of plays produced for a six year period (1946 through 1951). The 30 schools produced 692 full-length plays on their proscenium stages. These productions received the full attention of the theatre staffs, and maximum attention was afforded all aspects of the productions from a design standpoint. Specific information was gathered relative to (1) choice of plays, (2) styles of production, (3) staff problems, and (4) artistic and technical problems inherent in the production scheme.

A second purpose of the study was to inquire into the ways and means of ameliorating the conditions under which plays are produced in the college and/or university theatres which embrace the difficulties defined in the study. To implement this phase of the study, I attempted to examine thoroughly the extant works on design and stagecraft as they might relate to the problems discovered in the survey of the 30 schools. It became apparent, after prolonged study of the literature of the field of "amateur" staging, that no one work exists which deals completely with the problems so persistent in the rank and file of schools which produce plays in America. Many works were seen to refer to the near-ideal situation, the professional theatre, or the frankly amateur-beginner producing organization. Constructive suggestions were conspicuous by their absence in the contemporary literature of educational stagecraft and design.

Administrative policy which governs the actual producing of plays in the colleges and universities was noted to be responsible for several of the persistent problems which impede the professional production of plays on the several campuses. The survey showed that the following matters determined to a high degree the number, kind, and quality of theatrical offerings: (1) production schedules

which tend to overload the personnel charged with the production, (2) plays chosen because of their one-setting demands, (3) budget limitations which determine the number of staff, and the amount and kind of materials for staging, (4) a fear of audience responses to "deviations from the norm," and (5) the actual absence of any steady and working policy relative to professional-level stagings.

An inquiry into the problems related primarily to personnel indicated that the following persistent obstacles influenced the quality of stagings in the several schools: (1) a failure to assume a professional responsibility for the design process, (2) a lack of, or apparent disinterest in, a solid art training for scene design on the part of the director-designers, (3) a too loosely arranged "plan" for delegating responsibilities in the design process, (4) the time factor in the schedules of the personnel, and (5) the apparent haphazard methods of researching and recording data bearing on the actual stagings attempted.

The physical stages and their equipment were found to be very prominent hindrances to the achievement of a higher level quality in the scenery in the several schools. Specific data taken from the survey for the study showed that no one stage among the thirty examined could measure up to the criteria established by authorities in the field of educational theatre architecture.[1] This was especially true with respect to (1) the size of the actual stage, (2) the shape of the stage house, and (3) the dimensions of wing space on the stage. The most glaring limitations in equipment in the thirty schools were with gridiron rigging and lighting equipment.

With these three aspects of the study stated and evaluated, insofar as they touch on the actual design and staging processes, an attempt was made to determine the problems bearing on the styling of the productions. An agreement was reached between the writer and the several director-designers on the terminology of the several staging styles. The styles included in the study were observed to fall into two main groups, the "mainly representational" and the "mainly presentational" groups. It was found, by way of agreed definitions and the use of visual material to implement the survey, that 597 productions of the first style and 95 of the second style were staged. Obviously the former mode of staging is much better represented than the second. It was determined, by close questioning, that this fact arose from several factors, among which were policy, the abundance of the "realistic" type of play, and a lack of imagination on the part of the director-designers. This last factor was freely admitted by most of the director-designers.

Pictorial examples of the several styles most often attempted by the rank and file of schools are included in the dissertation. These pictorial recordings are accompanied by a specific statement defining each of the stagings and establishing each one as representing a staging style. These visual recordings, in the form of photographs, are included to serve as a means of communication with the reader and to clarify the later discussions of "realistic" and "modified realistic" stagings contrived for the creative portion of the dissertation.

With the basic problems discovered and defined in the study, and with the attempted styles of stagings defined and illustrated, it seemed necessary to inquire into the best ways and means of staging from an artistic and a technical standpoint. This was essentially an inquiry into the design process as practiced by the college and university scene designer and as discussed by the best minds of the contemporary theatre.[2] Some definite attempt was made in this portion of the research to define specifically the best design procedures for the designer who must work in the theatre of limited means. A concensus of opinion among the best contemporary designers seemed to point to a generalized "credo" for the educational theatre designer. The one credo accepted for this study was enunciated by Donald Oenslager.[3] His ten "affirmations" were taken prima facie as a justifiable guide for any and all designing in the theatre of our time.

Specific conclusions reached relative to the actual design practice to be followed are (1) Adequate preparation must be made for the design process; (2) assiduous attention must be given to the background of the play to be produced; (3) the director-designer must be en rapport with the play itself, and (4) vigorous controlled experimentation must be employed. It was further concluded in this discussion of the design process that the designer is obligated to keep the staging in its proper value in the production as a whole; the staging is seen to be the servant of the play, and the designer is the lieutenant of the director of the play: he is to the director what the architect is to his client.

Controlled experimentation is advocated in the study as the most effective means of improving the general status of the stagings in the majority of college and university theatres. The study does not advocate the rash embracing of "new and novel means of contemporary staging" as an escape from the exacting demands of staging the play in a realistic manner. Techniques of the contemporary architects and easel painters are to be regarded in their proper values; they include only some of the possible means for varying the stagings of plays. Verisimilitude, traditionally treated, is still to be reckoned with in the educational theatre which claims to be truly "experimental" and "educational." The study advocates the use of any and all conceivable means of staging in the educational theatre if they can be achieved with any marked degree of success. This view is regarded as quite defensible on the grounds that the educational theatre is obligated to teach as many aspects of the staging of plays as possible. Traditional as well as contemporary techniques--artistic and technical--are to be exploited for their values in the teaching of theatre.

The original design offerings in the study are primarily included (1) to illustrate the demands of a high degree of realism in the multi-set play, and (2) to illustrate the effectiveness of some departures from the more exacting forms of realism. A site was chosen for the staging of a play of great merit and literary stature: George Bernard Shaw's eight-scene play, Saint Joan. It presents manifold problems which must be met if the production is to be successfully staged by amateurs. Furthermore, it presents, as a play, a rich background in which the designer may probe for the telling visual motifs for his staging.

A definite inquiry was made into the sources for the design motifs and elements, those visual objects and phenomena which are the raw materials for all stagings. Nature and Art were seen to be the prime sources for the designer. In the latter category, architecture was regarded as the most important source to the designer.[4] From architecture the designer is required to select those motifs most useful and significant to the telling and re-enforcing of the dramatic theme. In addition, architecture is the one

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

art most associated with man's struggels, loves, triumphs, and defeats. It is his major storehouse for the theatrical backgrounds for most plays.[5] The choosing of the right motifs and the right elements is the designer's major problem insofar as the appearances of the stagings are concerned. The designer's best tool is a well-grounded knowledge of art and architecture and nature in their many aspects.

With the specific limitations of policy, staff, and physical theatre clearly in mind, the designer must select and adapt the most telling motifs to the particular production situation in which he works. The study shows that no two production conditions are exactly alike in the 30 schools, but all have common problems and all face definite limitations which seem to call for controlled designing. The two original, laboratory-tested design plans for Saint Joan incorporated in the dissertation indicate that the college scene designer cannot hope to achieve a high level of quality in his stagings unless he is willing and able to exercise great ingenuity in the planning of the scenery for his multi-set plays. Space, or the lack of it, looms as perhaps the largest of his basic, specific, technical problems. If matters of scale, size, line, color, light, and texture are haphazardly handled, the quality of the staging shall surely suffer.

The principal tentative conclusions of the study point to the necessity for a re-appraisal of the design and staging methods of the rank and file of college and university theatres of America. All suffer and are limited by the three factors of administrative policy, personnel preparation and organization, and the physical plants of the theatres. The very choice of plays seems to call for a more imaginative approach, and once chosen, the plays seem to demand a high degree of intelligent and imaginative treatment in order to improve the quality of the stagings.

Since the basic problems enunciated in the study seem to be subject to some degree of solution (as the study shows), the college designer can profit most by vigorously analyzing his own local situation, accepting the best advice of authorities, and finally capitalizing on the apparent shortcomings of his production situation. He is likely to realize almost immediate improvement in the quality of his stagings if he is willing to compromise and experiment, and dares to reject the almost overwhelming practice of staging most plays in the strongly realistic style.

Microfilm $4.90; Xerox $16.40. 384 pages.

1. Burris-Meyer, Harold and Cole, Edward C. Scenery for the Theatre. Boston: Little Brown and Co., 1946, pp. 18-19.

2. Houghton, Norris. "The Designer Sets the Stage," Theatre Arts Monthly, 21 (1927), p. 116.

3. Gilder, Rosamond, "Who's Who in the Tributary Theatre," Theatre Arts Monthly, 26 (9142), p. 472.

4. Oenslager, Donald. Scenery Then and Now. New York: W. W. Norton Co., 1936, p. 12.

5. Souriau, Etienne. "The Sphere and the Cube," Educational Theatre Journal, 4 (1952), p. 12.

Abstract published by special arrangement with the Ohio State University.

AN EXPERIMENTAL STUDY OF THE ROLE OF COVERT AND OVERT MATERNAL REJECTION AND ACCEPTANCE IN THE ETIOLOGY OF STUTTERING

(L. C. Card No. Mic 59-1850)

Donald Butler Kinstler, Ph.D.
University of Southern California, 1959

Chairman: Professor William Perkins

This study was formulated in an attempt (1) to create a usable scale which would differentiate between the attitudes of mothers of stutterers and mothers of children with normal speech and (2) to test the clinical hypothesis that the mothers of stutterers reveal a greater degree of covert or hidden rejection than do the mothers of normal speakers. Corollary hypotheses were that the mothers of stutterers display less overt or manifest rejection, less covert or implicit acceptance, and more overt acceptance than do the mothers of normal speakers. A questionnaire, which was called the USC Maternal Attitude Survey, was constructed to measure the accepting and rejecting attitudes of mothers toward their children.

Sixteen judges classified the questionnaire items into categories of overt rejection, covert rejection, overt acceptance, or covert acceptance. Overt rejection was defined as undisguised rejection which could be viewed from a social standpoint as a rejecting attitude. Covert rejection consisted of attitudes toward children which could be justified by the mother and receive social approval but might be sensed by the child to be rejecting. Overt acceptance referred to open, warm, loving attitudes. Covert acceptance consisted of hidden acceptance in the form of respect for the child's individuality.

The questionnaire was administered to thirty urban mothers of young male stutterers and to thirty urban mothers of young male children with normal speech. The groups were matched for age, education, socioeconomic status, age of children, religion, size of family, psychological guidance, and education of husbands.

The results revealed significant differences in the total pattern of responses of the two groups. Chi-square analysis of the distribution of the questionnaire responses yielded a value of 28.166, which is far beyond the p value of 13.277 (four degrees of freedom) for the 1 per cent level of confidence.

To the extent that the USC Maternal Attitude Survey is a valid measure of overt and covert rejection and acceptance, the following conclusions derived from its ability to differentiate between the attitudes of mothers of young male stutterers and the mothers of young male non-stutterers appear to be warranted: (1) Mothers of male stutterers reject their children covertly more than do mothers of normal speakers. (2) Mothers of male stutterers reject their children overtly far less than mothers of normal speakers. (3) Mothers of male stutterers accept their children covertly less than do mothers of normal speakers. (4) Mothers of male stutterers accept their children overtly slightly less than do the mothers of normal speakers. (5) Mothers of stutterers reject their children more than they accept them. Mothers of normal speakers accept their children more than they reject them. (6) Mothers of stutterers, when forced to choose between covert rejection and any other category, choose covert rejection more than

do the mothers of normal speakers. (7) Mothers of stutterers, when forced to choose between overt rejection and overt or covert acceptance, choose overt or covert acceptance more than do the mothers of normal speakers.

One purpose of this study, the construction of a measuring device which would differentiate between the attitudes of mothers of male stutterers and the attitudes of mothers of normal speakers, has been accomplished as far as this sample is concerned. The second purpose, the testing of the clinical hypotheses, has also been accomplished insofar as the scale devised does demonstrate that the mothers of stutterers reveal more covert rejection, less overt rejection, more overt acceptance, and less covert acceptance than do the mothers of normal speakers.

Microfilm $2.00; Xerox $6.20. 129 pages.

A COMPARISON OF GAINS IN COMMUNICATIVE SKILLS, RESULTING FROM GROUP PLAY THERAPY AND INDIVIDUAL SPEECH THERAPY, AMONG A GROUP OF NON-SEVERELY DYSARTHRIC, SPEECH HANDICAPPED CEREBRAL PALSIED CHILDREN

(L. C. Card No. Mic 59-2090)

Martin A. Sokoloff, Ph.D.
New York University, 1959

The purpose of the study was to compare the relative effectiveness of group play therapy and individual speech therapy in alleviating speech problems relating to cerebral palsy, and to study the relationship between these speech problems and intelligence and social and emotional development.

Twenty-four non-severely dysarthric, speech handicapped, cerebral palsied children in the Burke Foundation Cerebral Palsy Clinic were divided into two groups, with respect to age, sex, and intelligence. All children in the study were tested for intelligence with the Ammons Full-Range Picture Vocabulary Test. The Vineland Social Maturity Scale was administered to a parent of each child to ascertain his social development level, and a personality rating scale, specially designed for the study, was completed for each child, by each of the therapy departments of the Clinic. Tape recordings were made, at the beginning and end of the study, of each child responding to the Blackie Pictures.

One group, selected as the experimental, received thirty one-hour sessions of group play therapy. The children in the second, or control, group received thirty half-hour sessions of individual speech therapy.

At the end of the period covered by the study, all the children were again evaluated for intelligence, social maturity and personality development, using the same instruments. The speech recordings were rated, on the basis of individual improvement, by a panel of six judges.

Examination of the date revealed the following comparisons:

1. There was no statistically significant difference in Intelligence Quotient distribution in the Experimental group, Control group, or the entire group, between the pre-study and post-study scores.
2. While there was no difference between the Social Quotient distributions of the Experimental and Control groups at the beginning of the study, there was a difference at the end of the study, between the Experimental and Control groups approaching statistical significance on the five percent level of significance, between the pre-, and post-study distributions of the Experimental group on the five percent level of significance, and between the pre- and post-study distributions of the total group approaching the five percent level of significance.
3. There were changes in both the Experimental and Control groups in Personality ratings before and after the study. While the changes in the Control group were not statistically significant, the changes in the Experimental group were significant on the one percent level of confidence, particularly in the areas of Attention and Concentration, Responsiveness to Therapeutic techniques, Social Confidence, Self Confidence, and Appropriateness of Non-Verbal and Verbal Hostility.
4. On the basis of the judge's ratings the children in the experimental group showed more significant general improvement in communicative ability and in the specific categories of Articulation, Intelligibility, Vocabulary and Language Level, and Voice.

From the foregoing observations, it was concluded that the group play therapy was more effective than individual speech therapy in producing improvements in Speech and Communication, Social Development, and such personality factors as Responsiveness to Therapy, Social and Self Confidence and Appropriateness of Expressions of Hostility. Since these factors affect a child's progress in therapy, it is believed that group play therapy is an effective technique of supplementing not only speech therapy, but other forms of therapy for cerebral palsied children as well.

Microfilm $2.00; Xerox $5.00. 98 pages.

A HISTORY OF THE BROADCASTING OF DAYTIME SERIAL DRAMAS IN THE UNITED STATES

(L. C. Card No. Mic 59-2616)

Raymond William Stedman, Ph.D.
University of Southern California, 1959

Chairman: Professor Harwood

A highly durable form of daytime radio network program was introduced by the National Broadcasting Company in February 1932. The first daytime presentation of Clara, Lu 'n' Em followed approximately ten years of evolution, which began with the first serial dramas of radio and included the introduction of the very successful nighttime serial Amos 'n' Andy and the creation of the pioneer daytime serial Painted Dreams. Irna Phillips, who created Painted Dreams, and Frank and Anne Hummert were active in the origin of the new program form which developed rapidly in the mid-thirties.

Many of the early daytime serials such as Vic and Sade were light comedies, but after a few years most of the programs were heavy dramas which contained a plethora of crime and violence. Many serials followed a formula which closely resembled that of the American domestic novels of the nineteenth century. The Hummerts created

many of these formula serials, including Just Plain Bill, The Romance of Helen Trent, and Our Gal Sunday. Serials of several writers who did not employ the serial formula achieved recognition for literary merit. Sandra Michael's Against the Storm won a Peabody Award.

Although not all daytime serials followed the formula, many of them had common characteristics which included prominence of present-day action that was centered in the home, slowly moving revolving plots, strong heroines, and the Protestant ethic. The slowly moving plot resulted from complaints by listeners that the early serial stories progressed with uncomfortable rapidity. Researchers later discovered that on average a listener to serials heard two or three episodes of a given serial each week.

Throughout their history daytime serials attained the highest program-ratings of all daytime radio programs. The daytime serials of television also achieved popularity during the years following their introduction in 1950. The peak in the number of daytime serials occurred in the season of 1940-1941, when approximately sixty serials were presented by the major networks each day. This abundance of serials led to adverse criticism because of their domination of daytime radio hours. Later criticism was of allegedly harmful features of the programs, which supposedly appealed to poorly educated women who were in lower social groups. When researchers examined the audiences of serials, they found that a typical listener to daytime serials did not exist. Significant differences between women who listened to serials and those who did not were not found. Researchers learned that daytime serials offered various attractions to listeners. Both critics and researchers noted that listeners to serials often identified themselves closely with the characters in the programs.

The durability of the form of the daytime serial drama seemed to be related strongly and principally to the continuing narrative, which was the only major unifying characteristic of successful daytime serials and was the only characteristic of the serial which was not found in the generally unsuccessful non-serial dramas of radio and television. No historical evidence indicated that any other characteristic was of principal importance. The longest-lasting and most successful serials were those which exploited the continuing narrative to the greatest extent. Serials which frequently changed characters and stories were singularly unsuccessful. Evidence indicated that the importance of the continuing narrative resulted primarily from the use of long-continuing dramatic agents who could be heard at the same hour year after year and with whom listeners could identify themselves closely. Prolonged dramatic actions, which suggested the pace of real life, apparently encouraged the identification. Other characteristics of serials, such as strong and useful female characters, probably served to enhance the appeal of the programs to some listeners and to strengthen the identification.

Microfilm $4.40; Xerox $14.80. 341 pages.

THE DEVELOPMENTAL ANATOMY OF THE AIRSACS OF THE HOUSE SPARROW, Passer Domesticus (Linnaeus)

(L. C. Card No. Mic 59-1783)

John Maurice Delphia, Ph.D.
The University of Nebraska, 1959

Adviser: Professor Otis Wade

The purpose of this study is to establish the origin and development of the airsacs in the house sparrow and compare the anatomy of the adult airsacs of this species and certain other Passeriformes with other birds described in the literature.

Embryos and nestlings of the house sparrow were studied by means of serial sections. The respiratory systems of nestlings and adults were injected with liquid latex; these specimens were studied either by gross dissection or by study of the rubber casts obtained by digestion of the tissues. Respiratory systems of adults of one or more species from each of the following families of Passeriformes were injected with liquid latex and studied by one of the methods used on the adults of Ploceidae: Corvidae, Icteridae, Turdidae, Hirundinidae, Fringillidae, Tyrannidae.

Origin and general location of each of the secondary bronchi in the house sparrow are established. Tertiary and lesser bronchial subdivisions related to airsac origins or airsac connections to the lungs are also described. The origins, locations, lobations and further subdivisions, connections to the lungs, communications between airsacs or airsacs and subdivisions are described.

Adults of the six families (above) showed no significant variations when compared with adults of the house sparrow.

Cervical airsacs compare by origin, location and subdivisions with those of other birds described in the literature.

Interclavicular airsacs are composed of mesial and lateral moieties as in numerous other birds. The mesial and lateral moieties by origin are homologous with the respective moieties in the chicken.

Numerous subdivisions of the mesial moieties indicate that some of the lobations or ramifications common to the lateral moieties of certain birds are performed by the mesial moieties. Numerous communications between the mesial moieties and the intermediate airsacs explain the conception of a common single anterior thoracic airsac encompassing all the area occupied by the mesial and lateral moieties and the intermediate airsacs.

Separation of the mesial and lateral moieties by the thoracic lobes of the intermediate airsacs and the lack of subdivisions or lobes of the lateral moieties is coincident with the development of the posterior scapular lobes which occupy the area held by lobes or diverticula of the lateral moieties in certain other birds. The dorsal canals of the

posterior scapular lobes are comparable to the connections between the subscapular lobes and diverticula of the cervical airsacs in other birds.

Anterior abdominal airsacs, their primary and secondary ostia, the auxiliary connections and the location of the airsacs are homologous with those of the white pekin duck.

Origins and locations of the posterior abdominal airsacs are typical for all birds possessing these posterior projections from the lungs. Migration of the mouths of certain secondary bronchi from the lungs to the airsacs is as described for the white pekin duck. The lobes of these airsacs are comparable to those of the pigeon.

Certain diverticula of the pars ovali enter the medullary canal of some of the cervical and thoracic vertebrae. The anterior axillary lobes each produce a minute projection which penetrates the anterior end of the humerus. No other pneumatizations are observed.

Microfilm $2.25; Xerox $7.80. 169 pages.

FURTHER STUDIES ON TOXOPLASMA

(L. C. Card No. Mic 59-2663)

Dominic Patrick Gangi, Ph.D.
Syracuse University, 1959

Toxoplasma gondii, an obligate intracellular parasite, was originally found in an African rodent. Unlike most parasites, this organism is not host specific. Naturally occurring toxoplasmosis has been reported from mammals, reptiles, and birds. Successful laboratory infections have been recorded from mammals, amphibians, reptiles and birds. Infections have been described in humans which may be serious particularly in infants.

At least three avian species have been shown to have natural infection of Toxoplasma; and thus suggesting the possibility that birds may play a part in the epidemiology of the parasite. For this reason, a survey of wild birds was undertaken to find naturally acquired infections.

The following species were examined for toxoplasmosis: five hundred and eight English sparrows (Passer domesticus domesticus), seventy-six cowbirds (Molothrus ater ater), and one grackle (Quiscalus quiscala). Within twenty-four hours after the birds were brought into the laboratory, the brains, livers, spleens, and lungs of a group of one species of bird were pooled and homogenized in physiological saline. A portion of the suspension was injected into a series of mice; and after a period of observation, from ten days to two weeks, the mice were sacrificed and an homogenate of the brains, livers, spleens, and lungs was subinoculated into a second series of mice. Serial passages were continued in cases where symptoms of infection were observed. In the birds examined, no naturally occurring toxoplasmosis was detected.

Experimental infections were produced in English sparrows (P. domesticus domesticus) and in parakeets (Melopsittacus,undulatus) with the RH (of human origin) and MZ (isolated from a crow) strains of Toxoplasma. Both species of birds are susceptible to infection with either strain of parasite and the infection was of a chronic kind.

Because the morphology and type of reproduction that may occur in Toxoplasma are unsettled with regard to observations made with the ordinary light microscope and staining techniques, the MZ and RH strains were compared cytochemically. The parasites were collected from exudate of mice infected with the MZ or RH strain and were wet-fixed by placing a drop of the exudate on slides that were maintained in a moist chamber at about 40°C. The cells and parasites were allowed to settle on the slide. The original ascitic fluid was removed from the slide and the cells and parasites that remained on the slide were washed twice with physiological saline. The slides were fixed in ten per cent formalin or acetic acid alcohol.

Reproduction was followed by staining desoxyribose nucleic acid with Schiff's reagent. Both strains appear to divide by longitudinal binary fission; and the nuclei generally appear vesicular.

Glycogen was demonstrated by the periodic acid-Schiff technique with diastase hydrolysis. Glycogen was distributed throughout the cytoplasm of both strains of Toxoplasma.

Fast Green (FCF) at pH 8.0 was used in an attempt to cytochemically demonstrate basic protein in both strains of Toxoplasma. In all the toxoplasmas observed, no basic protein was stained.

As a result of staining the parasites with toluidine blue at pH 4.3 after ribonuclease hydrolysis, it is concluded that each strain of Toxoplasma has cytoplasmic ribonucleic acid and a nucleolus.

Two controls were used for ribonuclease hydrolysis; one at 40° C and the other at 0°C. The parasites of the 40° C solution stained unevenly with toluidine blue at pH 4.3 as compared with the parasites of 0° C. In addition, the 40° C solution had ultraviolet absorption at two hundred and sixty and two hundred and eighty microns after incubation and the 0° C solution had none. It is suggested that a hydrolytic enzyme may be present degrading the RNA of the toxoplasmas.

Microfilm $2.00; Xerox $6.20. 129 pages.

A STUDY OF THE PHYSIOLOGICAL PROCESSES ASSOCIATED WITH THE EMISSION OF SPERMATOZOA IN THE LEOPARD FROG, RANA PIPIENS

(L. C. Card No. Mic 59-2718)

Maurice Leroy Giltz, Ph.D.
The Ohio State University, 1954

The male leopard frog, Rana pipiens, test for pregnancy, announced by Wiltberger and Miller,[1] and Robbins and Parker,[2] has stimulated investigators to determine the physiological processes involved in the release and emission of spermatozoa. Robbins and Parker[3] reported the emission of spermatozoa following injections of adrenergic substances. Giltz and Miller[4] noted the emission of spermatozoa following the injection of distilled water, pond water, or tap water in amounts exceeding 20 per cent of the body weight of the frog. Biesinger and Miller[5] studied histological sections of the testes before and after injections of pregnancy urines. McCourt[6] sectioned the testes longitudinally and found that there was an anterior-posterior gradient of the tubules of the testes in which mature spermatozoa were found. Kissen[7] reported the emission of spermatozoa in the urines of hypophysectomized

frogs following the injection of either pregnancy urines or anterior pituitarylike hormones.

Notwithstanding these investigations on Rana pipiens, and the inferences to be drawn from earlier work on pituitary-gonad relationships of other species of frogs summarized by Houssay,[8] the exact influence which gonadotropins exert upon the urogenital system was not yet determined. The influence of adrenergic substances, water, pituitary substances, and the pregnancy urine hormone on physiological processes of animal tissues are not generally believed to be the same. However, the effects of these substances upon the frog all seemed to be correlated with the emission of spermatozoa in its urine. The results of the present investigation help to clarify the part which these substances play in bringing about the movement of spermatozoa from the testes to the bladder.

The first area of investigation was devised to study excised testes, which were observed in order to determine whether there was an emission of spermatozoa from the testes into various fluids in which they were immersed. The second area of investigation involved a study of testes in situ following gonadotropic and non-gonadotropic subcutaneous injections. The third area of investigation involved frogs which had partial or entire brain extirpations preceding subcutaneous injections of either gonadotropic or non-gonadotropic substances.

Materials. — The frogs used in these experiments were the leopard frog, Rana pipiens, procured from commercial suppliers. They were stored in groups of 25 in an aquarium in a refrigerator at approximately 45° F. The saline solution used was Ringer's solution for cold blooded animals, prepared according to Lee.[9] Ayerst brand of chorionic gonadotropin ("APL") was used. It contained 100 international units (I.U.) per cubic centimeter of solution. It was diluted with distilled water or saline solution according to the number of international units desired for the various experiments. The adrenalin used was Parke, Davis and Company, 1:1000. The human pregnancy urines (H.P.U.) were from samples submitted for pregnancy diagnosis.

EXPERIMENTS WITH EXCISED TESTES

The emission of spermatozoa from excised testes. — Glass and Rugh,[10] Biesinger and Miller,[5] and McCourt[6] have made histological studies of testicular tissue which was removed from treated and untreated frogs. In these studies a change in position of spermatozoa from the periphery, where they are attached to Sertoli cells, to the center of the tubules, where they are usually free from the Sertoli cells, was associated with the injection of gonadotropins. However, the association of this reaction with injections does not preclude the possibility that the injections act on some structure other than the testes. In my study, experiments were devised to determine whether gonadotropins have an effect upon the movement of spermatozoa from the Sertoli cells at the periphery to the lumen of the tubules and out of the excised gonads.

Each excised testis was placed into one cc of saline. To these were added various titers of anterior pituitarylike hormone, human pregnancy urine, or adrenalin. In no case did these excised testes give off spermatozoa; thus no relation was found between these substances and the emission of spermatozoa from excised testes. However, when excised testes were placed in such hypotonic solutions as distilled water, frog urine, and tap water, or when hypertonic solutions were made hypotonic, the testes did give off spermatozoa. In other words, testes in hypotonic solutions emitted their spermatozoa, and testes in isotonic or hypertonic solutions did not emit their spermatozoa. There should be an explanation for this. It is believed that the hypotonic fluids diffuse into testicular tissue, creating a pressure which releases the spermatozoa from their Sertoli cells and causing them to be expelled from the testis. This belief is supported by the absence of Sertoli cells in emissions from the testes in these experiments and by their presence in emissions induced by a mechanical pressure as reported by Rugh.[11] It seems probable that the diffusion pressures set up by the hypotonic solutions may fracture the Sertoli cells, thus releasing the spermatozoa, after which additional diffusion pressures on the tubules might expel the spermatozoa from the tubules into the surrounding fluid.

The volume of excised testes associated with the emission of spermatozoa. — Each excised testis was measured at the time it was placed in either hypotonic or hypertonic solutions and also after it had remained one hour in the solution. It was found that only those testes which emitted their spermatozoa increased in volume. This indicates that spermatozoa were released only when a diffusion into testicular tissue took place. It appears that increased volume in excised testes is caused by a diffusion pressure resulting from the entrance of a hypotonic fluid, which expresses the spermatozoa.

EXPERIMENTS WITH TESTES IN SITU

The relation of the volume of testes in situ to the emission of spermatozoa. — Testes in situ were measured preceeding and following subcutaneous injection of 100 I.U. of anterior pituitarylike hormones in 2 cc of distilled water, 4 cc of human pregnancy urine, or 10 cc of distilled water. These testes increased in volume and emitted spermatozoa. Similar measurements were made on testes in situ of frogs receiving subcutaneous injections of 2 cc of distilled water, 4 cc of non-pregnancy urine, and 10 cc of saline. These testes did not increase in size nor did they emit spermatozoa. The increase in volume is therefore associated with an emission of spermatozoa in intact testes. The increased volume can be explained on the basis of an increased diffusion pressure resulting from the entrance of a hypotonic fluid. In this experiment the frogs which were injected with substances associated with a release of spermatozoa were the only ones whose testes increased in size. Therefore, these substances, anterior pituitarylike hormones, human pregnancy urines, and water in 10 cc amounts, are believed to act on a structure of the urogenital system in such a manner that a hypotonic fluid is introduced into the testes.

Observations on the urogenital system of injected frogs. — Visual observations were made on the urogenital system of frogs which had received a subcutaneous injection of 100 I.U. of anterior pituitarylike hormones or human pregnancy urines. When the frogs received these injections, the glomeruli and Bowman's capsules swelled and became visible through the surface of the kidney. This was associated with an increase in testis volume as well as an emission of spermatozoa. However, when similar observations were made on frogs which received an injection of either two cc of water or non-pregnancy urine,

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there were no swellings in either the glomerulus of the capsule, nor did these testes increase in size or release their spermatozoa.

Richards et al[1,2] determined that the addition of adrenalin in certain titers resulted in a swelling of the glomeruli. Since the leopard frog responds to adrenergic substances, human pregnancy urine, and anterior pituitarylike hormone by releasing spermatozoa and the glomerulus swells when these substances are applied, it may be possible that the action of anterior pituitarylike hormones and human pregnancy urines may also cause the constriction tion of the efferent vessel of the glomerulus.

EXPERIMENTS WITH BRAIN EXTIRPATIONS

The effect of various brain operations on the emission of spermatozoa from the testes to the bladder were studied. When the olfactory lobes, cerebral hemispheres, pituitary and cerebellum were extirpated, there was an emission of spermatozoa following the injection of gonadotropins. However, when the entire midbrain or the optic lobes alone were extirpated, there was no emission of spermatozoa. Therefore, it was concluded that the optic lobes exerted a neural control on the urogential system. In the light of the evidence of the stimulating effect of hypotonic solutions on the emission of spermatozoa, it appears that the influence of gonadotropins is exerted on the kidney. If this were the case, the destruction of the optic lobes may destroy or inhibit the muscular tone of the vascular system of the kidney.

CONCLUSIONS

From the results of the experimentations on excised testes, intact testes, and injections following brain extirpations the following conclusions appear to be justified:

1. Hypotonic fluids are associated with the release of spermatozoa from the testis.
2. An increase in the volume of the testis is associated with the movement of spermatozoa from the testis to the urine.
3. Gonadotropic substances are not associated directly with the release and emission of spermatozoa from the testis.
4. The association of an increase in testis size with the emission of spermatozoa seems to indicate the presence of a diffusion pressure within the testis.
5. There is visible evidence that seems to indicate that gonadotropic substances directly affect the kidney when spermatozoa are emitted.
6. When the optic lobes are extirpated, spermatozoa are not emitted following the subcutaneous injection of gonadotropins.

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Microfilm $2.00; Xerox $3.80. 66 pages.

Abstract published by special arrangement with The Ohio State University.

A STUDY OF THE EFFECTS OF WEATHER ON BREEDING BEHAVIOR, NEST ESTABLISHMENT, EGG LAYING, AND HATCHABILITY OF THE RING-NECKED PHEASANT

(L. C. Card No. Mic 59-2742)

Francis William Kessler, Ph.D.
The Ohio State University, 1959

A study of the effects of the weather elements on the ring-necked pheasant (Phasianus colchicus torquatus) was conducted during the reproductive season in 1955 and 1956 at the Delaware Farm Game Experiment Station near Delaware, Ohio. Approximately one hundred females and ten males were used during each year of the study. The birds were brailed and confined in a five-acre enclosure. A thermograph, maximum-minimum thermometers, rain gauges, an anemometer, and photometer were installed to measure the various weather elements with which the study was concerned.

Egg temperatures were measured by extending thermocouple wires from a 16-point potentiometer recorder to nests under observation. During 1955, temperature measurements were made throughout the incubation period of five hens. The average temperature of the eggs to which the thermocouple junction was attached in each of the five nests under observation was 98.3, 97.0, 96.4, 95.1, and

94.1° F. During 1956 egg temperature measurements were also made throughout the incubation period of five hens. The average temperature of the eggs to which the thermocouple junction was attached in each of the five nests under observation was 97.3, 96.2, 94.6, and 92.1° F. The relationship between the stage of incubation and the average daily egg temperature was investigated; the data showed that the average daily egg temperatures were fairly constant throughout all stages of the incubation period. The amount of rainfall had no noticeable effect on egg temperatures during incubation. The duration of rainfall had no noticeable effect on egg temperatures during incubation. The relationship between rainfall and nest desertion was investigated; during 1955, three hens deserted after an intense rain, and during 1956, four deserted. Nest attentiveness during incubation was influenced by the frequency of precipitation; the more frequent the periods of precipitation the more frequent the departure of the hen from her nest.

A study of nest attentiveness was made. Switches installed at the nest site were activated by the hen's presence and a graphic record of nesting activities was obtained. During 1955 the duration of incubation periods varied from 22 days and 23 hours to 23 days and 21 hours; the number of times hens departed from their nests during the incubation period varied from 26 to 46; the average duration of periods of nest inattentiveness varied from 36 minutes to 78 minutes. During 1956 the duration of incubation periods varied from 22 days 6 hours 30 minutes to 24 days 6 hours 45 minutes; the number of times hens departed from their nests during the incubation period varied from 33 to 112; the average duration of periods of nest inattentiveness varied from 43 to 78 minutes.

The relationship between total daily nest inattentiveness and the stage of incubation was investigated. Data collected indicated that the incubating hen spent a greater amount of time off the nest during the early and late stages of incubation than during the intermediate period.

The effect of wind on breeding behavior and dispersal was investigated. Winds of 15 to 18 miles per hour caused pheasants to congregate in dense cover, where strife resulted. As a result of such strife, some of the territorial cocks became submissive and remained so throughout the season. Microfilm $2.00; Xerox $6.00. 125 pages.

A STUDY OF THE EFFECTS OF SINGLE LOCUS HETEROZYGOSITY ON TRAITS WHICH MAY HAVE SURVIVAL VALUE IN EIGHT STOCKS OF LABORATORY MICE

(L. C. Card No. Mic 59-2744)

Edwin Paul Les, Ph.D.
The Ohio State University, 1959

Heterosis has two general modes of expression. In one there is an increase in size or number of parts; in the other there is an increase in biological efficiency, such as survival ability. The investigation was a search for (1) methods of detecting differences in the survival ability of mice and (2) evidence of whether mice heterozygous at a single locus are superior to mice homozygous recessive at the same locus in regard to survival ability as indicated by the tests to which they were subjected. The following were assumed to be factors in survival ability of mice: (1) locomotor activity, (2) ability to overcome an obstacle to movement by nibbling, (3) ability to move nesting material from a brightly lighted area to a shaded area, (4) ability to react emotionally in a way which might promote escape from confinement. The body weight of adult mice was measured as an indicator of biological fitness.

Eight stocks of mice were used in the investigation. Each stock was inbred with forced heterozygosis at one locus. The two phenotypes in each stock were tested for differences in survival ability with apparatus designed to measure locomotor activity, nibbling activity, transporting activity, reaction to stress, and adult body weight.

In two stocks, FS and HR, mice which were heterozygous were found to be more active than their homozygous recessive littermates in the first of two trials in the locomotor activity test. In the same test homozygous recessive mice of the YEL stock were more active than their heterozygous littermates. Heterozygotes of three stocks, ALB, MIS, and HR, were found to be distinctly faster than their homozygous recessive littermates in nibbling through a piece of perforated cardboard. No difference between genotypes was found in any of the stocks in a test of transporting activity or in emotionality as indicated by urination. In a test of emotionality as indicated by the number of fecal pellets eliminated during a period of confinement in a novel situation, heterozygotes of the HR stock were found to differ from homozygotes in the variability of the response.

Differences in adult body weight were found in five of seven stocks tested. In each case the heterozygotes were heavier, but, in the YEL stock, the greater weight of heterozygotes was not considered evidence of greater biological fitness because the nice tended to be obese.

A total of fifty-one tests were conducted during the investigation. Some of these were second trials and were not considered necessarily independent of the first trials. A difference between heterozygotes and homozygotes was found in fifteen of the fifty-one trials. In 86 percent of the cases in which a difference was found the heterozygotes were superior to homozygous recessives on the scale of measurement used in the test.

Microfilm $2.00; Xerox $5.80. 116 pages.

STUDIES ON THE HABITAT AND INCIDENCE OF MOSQUITOES IN UNIVERSITY OF WISCONSIN ARBORETUM

(L. C. Card No. Mic 59-2774)

Raojibhai Chhotabhai Patel, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Robert J. Dicke

An ecological study of mosquitoes was conducted in the University of Wisconsin Arboretum from 1956 to 1958. Eleven larval breeding sites including permanent, semi-permanent and temporary breeding areas were observed from April through October. Records were maintained of

larval density, predaceous insects, water temperature, D. O., pH and aquatic flora.

1. Permanent Breeding Areas

(a) Lake shore sections: -- These areas were important breeding places for Urantoaenia sapphirina and Culex territans. Breeding appeared to be initiated after heavy rain during warm weather and the first species to appear was C. territans. U. sapphirina breeding was observed to be greatly retarded by the dry weather in 1958, whereas the numbers of C. territans remained relatively unchanged. C. territans predominated in one area and was apparently favored by a thick stand of cattail with considerable decaying vegetation and blue-green algae. U. sapphirina predominated in other areas probably because of more open water containing algae (Spirogyra sp.).

(b) Stream area: -- This area maintained uniformly lower water temperatures because of a continuous inflow of cold water. Consequently the larval population remained very low and was comprised largely of C. territans. Slightly higher water temperatures and probably unfavorable breeding condition elsewhere caused an increased larval population during 1958.

(c) Marsh area: -- Important species breeding in this area were Culex salinarius, Culiseta inornata, C. territans and Culiseta minnesotae. The first three, however, comprised most of the collection. The relative abundance of these species varied greatly each year. During 1958, the area dried up and was reflooded twice with subsequent hatching of Aedes vexans.

2. Semipermanent Breeding Area

Several species of mosquitoes were collected from this area. These included early spring forms as Aedes stimulans, Aedes excrucians, Aedes fitchii and Aedes cinereus; permanent water forms as U. sapphirina, C. territans, Anopheles quadrimaculatus, Anopheles punctipennis, C. salinarius, Culex tarsalis, C. inornata, C. minnesotae and Culex erraticus, and such flood water forms as A. vexans, Psorophora ciliata and Aedes trivittatus. The predaceous insect fauna was abundant and actively regulated mosquito populations. Frequent floodings stimulated A. vexans to hatch but adult emergence was not pronounced because of predation or rapid drying of the area.

3. Temporary Breeding Areas

The most important species breeding in these areas was A. vexans. Although larvae hatched often after flooding, adult emergence was recorded only once. High larval populations in some areas coupled with the absence of predatory forms resulted in emergence of fantastic numbers of A. vexans adults. During 1957, the rainfall was above normal and appreciable numbers of Culex restuans and C. inornata were collected.

A. vexans comprised from 70 to 88% of the total mosquitoes collected in light traps during the three year study. High numbers of A. vexans were trapped in 1958 in spite of no observed emergence, indicating that this species probably migrated into this area.

Microfilm $2.00; Xerox $5.40. 106 pages.

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